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MARINE BOILERS

BARTOL

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VOLUME

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A

TREATISE

ON

THE MARINE BOILERS

OF THE

UNITED STATES.

BY B. H. BARTOL,

ENGINEER.

PHILADELPHIA:
R. W. BARNARD & SONS, PRINTERS.
.....
1851.

Entered, according to the Act of Congress, in the year 1851, by B. H. Bartol, in the Clerk's Office of the District Court of the United States, for the Eastern District of Pennsylvania.

TO THE

ENGINEERS OF THE UNITED STATES,

THIS VOLUME,

PREPARED FROM AUTHENTIC DRAWINGS,

AND

INFORMATION FURNISHED BY THEIR KINDNESS,

Is Respectfully Dedicated

BY THE AUTHOR.

56890

CONTENTS.

	Page.
Albatross,	60
Alida,	88
America,	108
America, (on Lake Erie,)	138
America, North	82
America, South	84
Anglo Saxon,	114
Arctic,	50
Armenia,	106
Atlantic,	42—44
Baltic,	48
Baltimore,	134
Belknap, Joseph	92
Cherokee,	40
City of Pittsburg,	64
Constitution,	74
El Dorado,	66
Falcon,	28
Fitch, John	122
Franklin,	52
Georgia,	18
Golden Gate,	72
Gorgona,	130
Hermann,	36—38
Humboldt,	54
Massachusetts,	78
Mayflower,	116
Merchant,	128
Michigan,	16
Mississippi,	6
Monumental City,	68
Mountaineer,	94
Nelson, John	132
Newton, Isaac	100
Niagara,	90
Northerner,	26
Ohio,	34
Onalaska,	124
Oregon,	86
Osprey,	56—58

Pacific, ... 46
Philadelphia, ... 30
Pioneer, ... 62
Powell, Thomas 104
Powhattan. 4
Princeton, ... 12—14

Republic. 32
Rescue, ... 80

San Jacinto, ... 10
Saranac, ... 8
Seneca, ... 126
State, Bay 110
State, Buck Eye 120
State, Empire 112
State, Empire (on Lake Erie) 118
Susquehanna, ... 2

Taylor, General 136
Traveller, ... 98
Union, ... 76
United States. 24

Vixen. 70

Washington, ... 20—22
Williams, Roger 102
World, New 96

ERRATA.

Page	2,	line 16	Dip of Wheel, *for* 5 ft. *read* 6 ft.
"	12,	" 8	Draft of Water, forward, *for* 15 ft. *read* 15 ft. 6 in.
"	12,	" 10	Area of Cylinders, *for* $17\frac{3}{4}$ *read* $17\frac{1}{3}$.
"	24,	" 1	*For* "running from New York to Liverpool," *read* "sold to Prussian Navy."
"	85,		After word "Flues" *read* "as those of the North America," &c.
"	120,	line 13	Length of Paddles, *for* 9 ft. 8 in. *read* 9 ft. 3 in.
"	"	" 16	Average Dip of Wheel, *for* 3 ft. 10 in. *read* 3 ft. 1 in.
"	"	" 26	Area of Chimnies, *for* 39 9-10ths sqr. ft. *read* 33 sqr. ft.
"	"	" 27	Height of Chimnies, *for* 75 ft. *read* 65 ft.
"	142,	" 7	from the bottom, *for* "our furnaces are" *read* "each furnace is."
"	143,	" 6	from bottom, *for* "differs" *read* "differ," and *for* "agrees" *read* "agree."

The following information has been received since the work was put to press:

TRIAL TRIP OF THE GOLDEN GATE.

Average number of Revolutions per minute,	$15\frac{1}{4}$
" Pressure of Steam,	$8\frac{1}{2}$ lbs.
" point of Cutting off,	3 feet.
Consumption of Bituminous Coal per hour,	3472 lbs.
Water Evaporated by 1 lb. of Coal,	$7\frac{7}{100}$ lbs.
Coal per hour to a square foot of Grate,	$9\frac{46}{100}$ lbs.

TRIAL TRIP OF BUCK EYE STATE.

Average number of Revolutions per minute,	16
" Pressure of Steam,	40 lbs.
Consumption of Bituminous Coal per hour,	3158 lbs.
Water Evaporated by 1 lb. of Coal,	$6\frac{18}{100}$ lbs.
Coal per hour to a square foot of Grate,	20 lbs.

The tubes in these boilers are 3 inches bore, and 15 feet long, and the natural draft is sufficient to give ample steam.

STEAMER BALTIMORE.

Average number of Revolutions per minute,	19
" Pressure of Steam,	30 lbs.
" point of Cutting off,	5 ft. 6 in.
Consumption of Virginia Pine wood per hour, $1\frac{1}{3}$ cords	3200 lbs.
Water Evaporated by 1 lb. of Wood,	$4\frac{36}{100}$

The Steamer Illinois, just finished at New York, is of the same size as the Golden Gate, and her Engines and Boilers, (constructed by the Allaire Works,) are of the same kind and dimensions.

A TREATISE

ON THE

MARINE BOILERS OF THE UNITED STATES.

The Fire Surfaces are all calculated from the top of the grate to the water line, which is taken at 12 inches above the flues.

All the boilers are drawn to a scale of $\frac{3}{16}$ of an inch to the foot. See scale on last page.

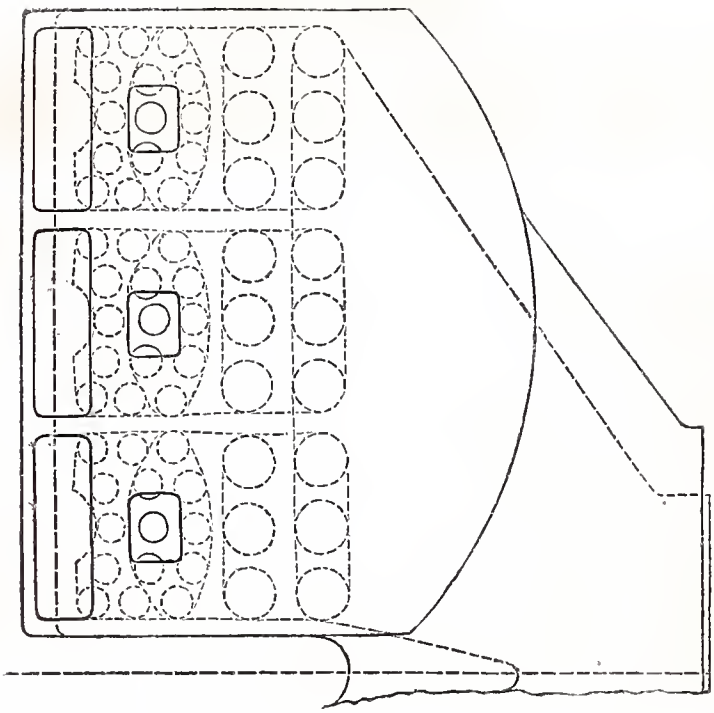
Unless noted otherwise, the draft is natural.

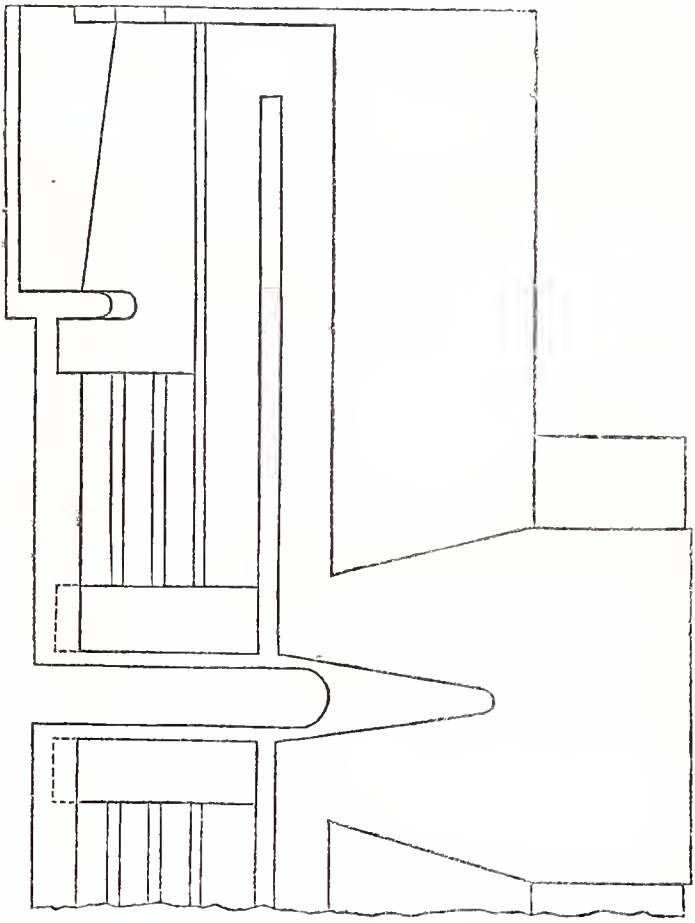
SUSQUEHANNA.

War Steamer belonging to the United States Navy. Engines and boilers designed by Charles W. Copeland, Esq., and constructed by Murry & Hazlehurst, of Baltimore.

	Feet.	Inches.
Length on Deck,	256	6
Breadth of Beam,	45	0
Depth of Hold,	26	6
Tonnage,	tons 2436	
Average Draft of Water,	18	6
Two Inclined Engines.		
Diameter of Cylinders,	5	10
Length of Stroke,	10	0
Diameter of Paddle Wheels,	31	2
Length of Paddles,	9	6
Depth of " 17 inches each, or	2	10
Number of Double Paddles in each Wheel,	26	
Dip of Wheel,	5	0
Average Number of Revolutions,	12	
Average Pressure of Steam,	lbs. 10	
Cutting off at	6	0
Four Copper Boilers (back to back).		
Whole amount of Fire Surface,	8652 square feet.	
" " Grate "	342 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$16\frac{1}{4}$ to 1.	
" " " Grate Surface,	25 to 1.	
Area of 1st Flues,	82 square feet.	
" 2d and 3d Flues, each	52 "	
" Chimney,	54 "	
Height of " above Grate,	65 feet.	
Consumption of Bituminous Coal per hour,	3270 lbs.	
Water Evaporated by 1 lb. of Coal,	$8\frac{4}{10}$ lbs.	
Coal per hour to a square foot of Grate,	$9\frac{1}{2}$ "	

Note.—The above result was obtained on her first run from Philadelphia to Norfolk. The steam chimney is attached to the boilers, and the steam from each admitted by a regulating valve, so arranged that one or more may be used at pleasure.



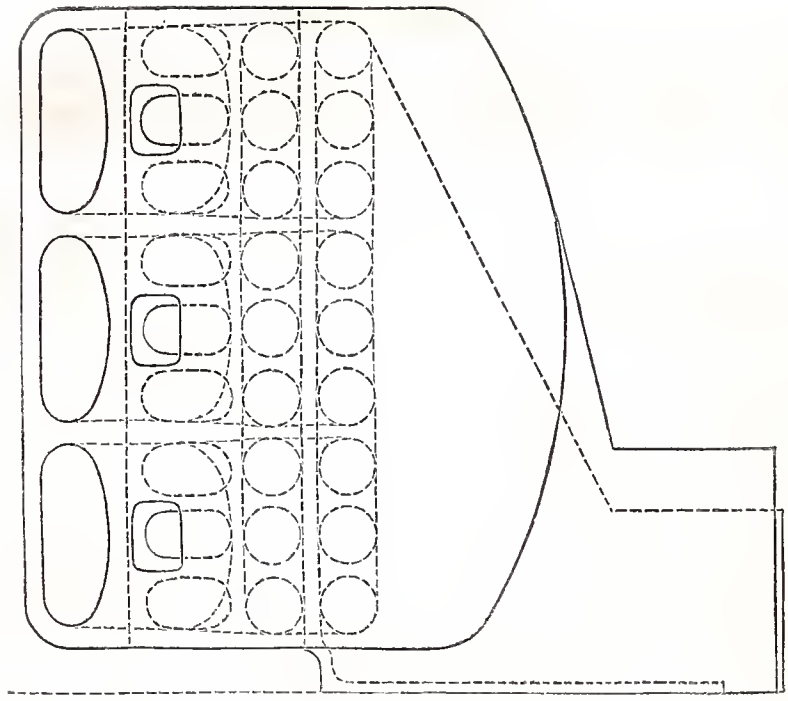


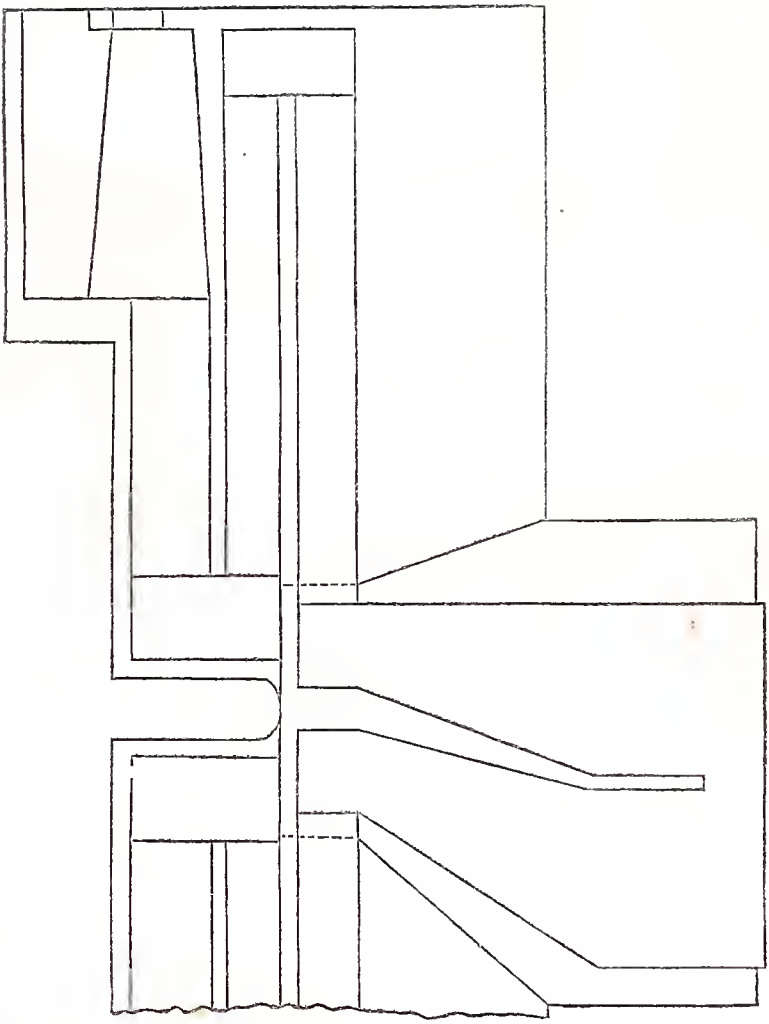
POWHATTAN.*

War Steamer belonging to the United States Navy. Engines and boilers designed by Charles H. Haswell, Esq., Engineer in Chief, United States Navy, and constructed by A. Mehaffy & Co., of Portsmouth, Virginia.

		Feet.	Inches.
Length on Deck,		251	0
Breadth of Beam,		45	0
Depth of Hold,		26	6
Tonnage,	tons 2419		
Estimated Draft of Water,		18	6
Two Inclined Engines.			
Diameter of Cylinders,		5	10
Length of Stroke,		10	0
Diameter of Paddle Wheels,		31	0
Length of Paddles,		10	0
Depth of " 16 and 14 inches each, or		2	6
Number of Double Paddles in each Wheel,	23		
Dip of Wheel at Estimated Load Line,		5	6
Average Number of Revolutions,	—		
Average Pressure of Steam,	—		
Cutting off at	—		
Four Copper Boilers (back to back).			
Whole Amount of Fire Surface,	7884 square feet.		
" " Grate "	353 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$14\frac{8}{10}$ to 1.		
" " " Grate Surface,	$22\frac{3}{10}$ to 1.		
Area of 1st Flues,	76 square feet.		
" 2d "	57 "		
" 3d "	57 "		
" Chimney,	$63\frac{1}{2}$ "		
Height of Chimney above Grate,	65 feet.		
Consumption of Bituminous Coal per hour.	—		
Water Evaporated by 1 lb. of Coal.	—		
Coal per hour to a square foot of Grate.	—		

* Not yet finished.



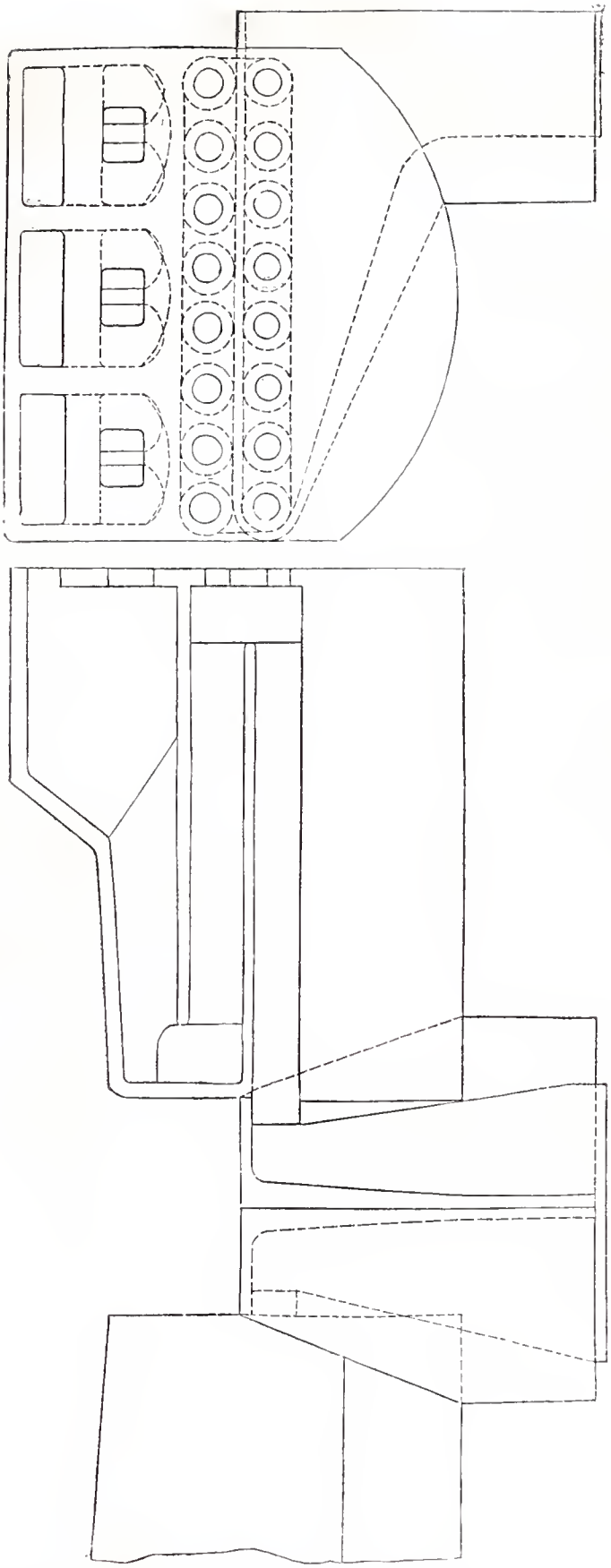


MISSISSIPPI.

War Steamer belonging to the United States Navy. Engines and boilers designed by Charles W. Copeland, Esq., and constructed by Merrick & Towne, of Philadelphia.

		Feet.	Inches.
Length on Deck,		225	0
Breadth of Beam,		40	0
Depth of Hold,		23	6
Tonnage,	tons 1788		
Average Draft of Water,		19	0
Two Side Lever Engines.			
Diameter of Cylinders,		6	3
Length of Stroke,		7	0
Diameter of Paddle Wheels,		28	0
Length of Paddles,		11	0
Depth of " 20 and 16 inches each, or		3	0
Number of Double Paddles in each Wheel,*	21		
Dip of Wheel,		6	0
Average Number of Revolutions,	11		
Average Pressure of Steam,	lbs. 12		
Cutting off at		3	0
Four Copper Boilers (back to back).			
Whole Amount of Fire Surface,	5400 square feet.		
" " Grate Surface,	290 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{6}{10}$ to 1,		
" " " Grate Surface,	$18\frac{6}{10}$ to 1,		
Area of 1st Flues at back end,	52 square feet.		
" 2d and 3d Flues, each	$44\frac{1}{2}$ "		
" Chimney,	$44\frac{1}{2}$ "		
Height of " above Grate,	65 feet		
Consumption of Bituminous Coal per hour,†	2650 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{77}{100}$ lbs.		
Coal per hour to a square foot of Grate,	$9\frac{14}{100}$ "		

* There are two rows of 21 paddles (half length) in each wheel.
† Result in Gulf of Mexico. Coal Inferior.



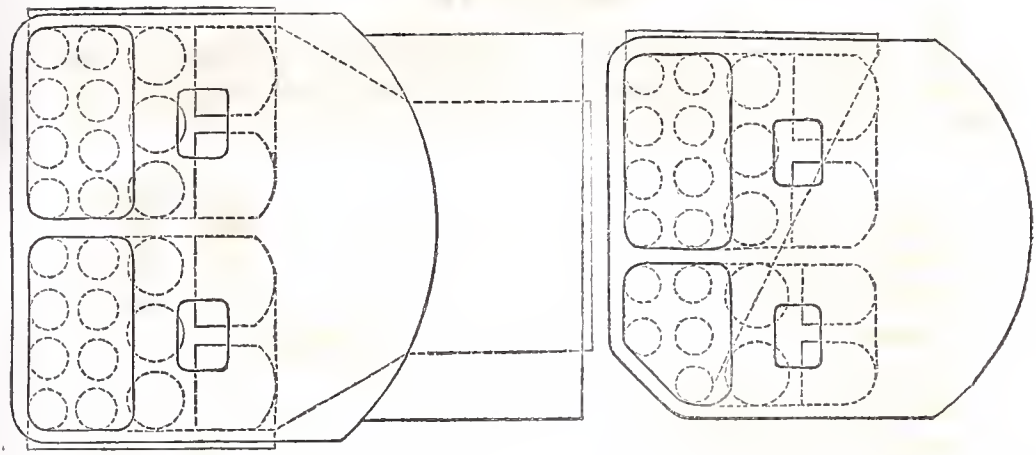
SARANAC.

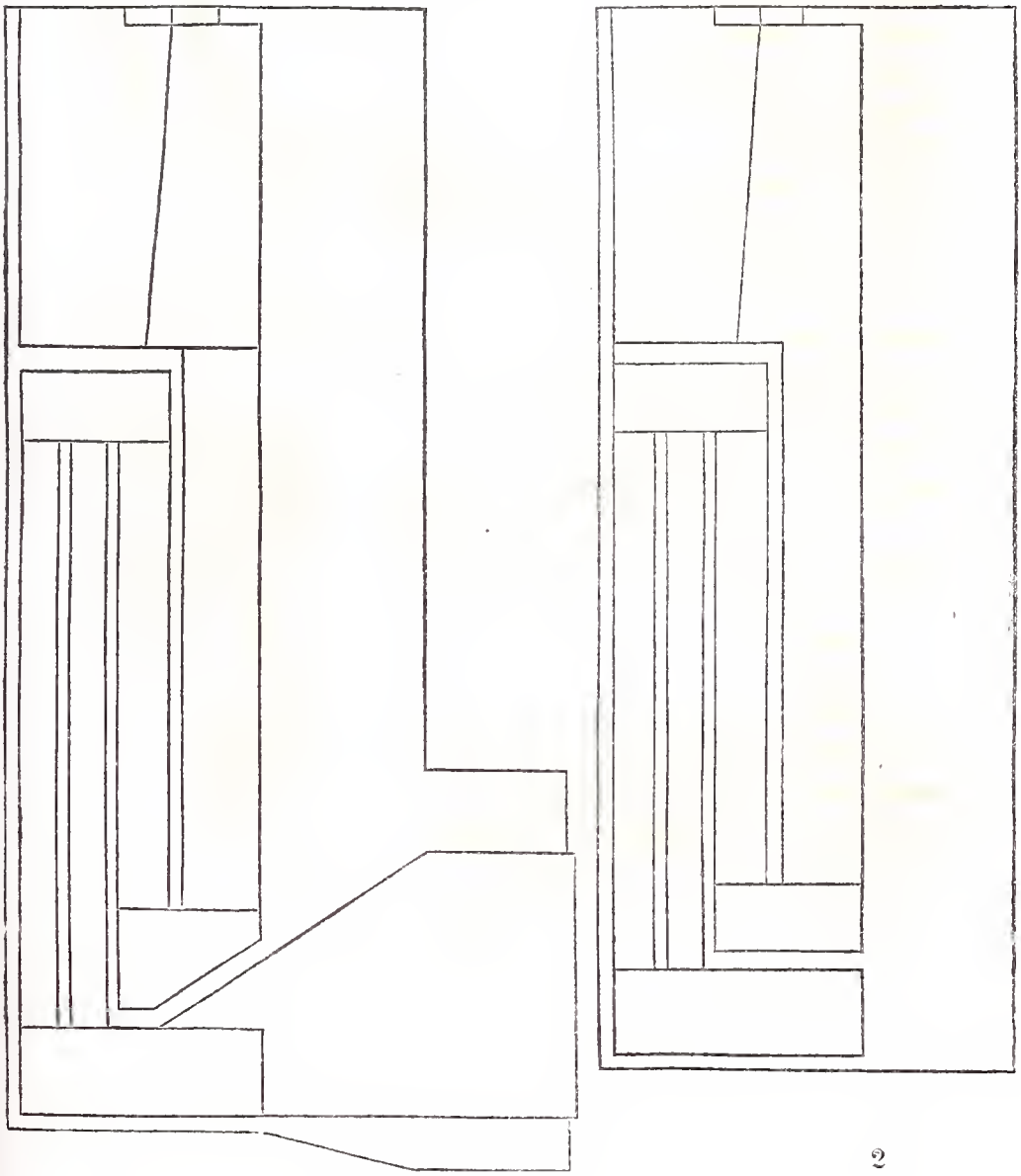
War Steamer belonging to the United States Navy. Engines and boilers designed by Charles W. Copeland, Esq., and constructed by Jabez Coney, of Boston.

	Feet.	Inches.
Length on Deck,	220	0
Breadth of Beam,	37	0
Depth of Hold,	23	3
Tonnage,	tons 1426	
Average Draft of Water,	17	0
Two Inclined Engines.		
Diameter of Cylinders,	5	0
Length of Stroke,	9	0
Diameter of Paddle Wheels,	27	6
Length of Paddles,	9	0
Depth of Paddles,	15 inches each, or 2	6
Number of Double Paddles in each Wheel,	22	
Average Dip of Wheel,	5	0
" Number of Revolutions,	13	
" Pressure of Steam,	lbs. 14	
Cutting off at	3	6
Three Copper Boilers (side by side).		
Whole Amount of Fire Surface,	5127 square feet.	
" " " Grate "	188 "	
Ratio of Fire Surface to Cubic Foot of Cylinder,	$14\frac{1}{2}$ to 1	
" " " Grate Surface,	$27\frac{1}{4}$ to 1	
Area of 1st Flues,	37 square feet.	
" 2d "	25 "	
" 3d "	$30\frac{1}{2}$ "	
" Chimney,	34 "	
Height of " above Grate,	62 feet.	
Consumption of Biltuminous Coal per hour,	1875 lbs.	
Water Evaporated by 1 lb. of Coal,	8 "	
Coal per hour to a square foot of Grate,	10 "	

Middle Boiler.

Side Boiler.



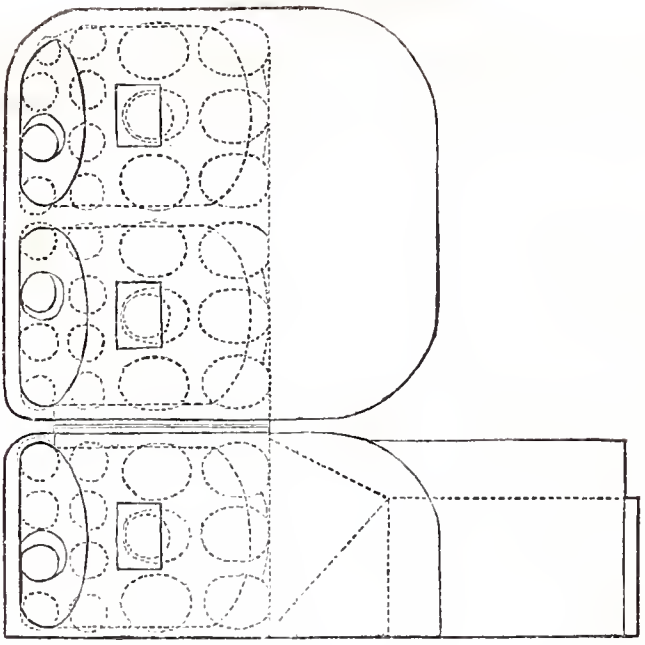


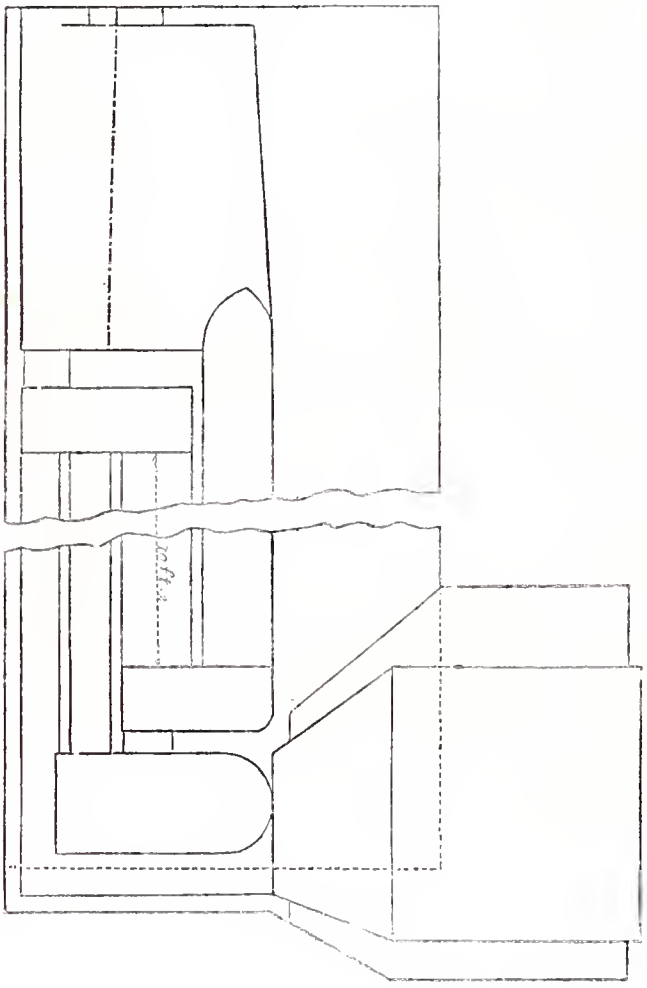
SAN JACINTO.*

War Steamer belonging to the United States Navy. Engines designed by Charles H. Haswell, Esq., Engineer in Chief, and constructed by Merrick & Son, Philadelphia.

	Feet	Inches.
Length on Deck,	220	0
Breadth of Beam,	37	0
Depth of Hold,	23	3
Tonnage,	tons 1426	
Average Draft of Water,	—	
Two Inclined Engines.		
Diameter of Cylinders,	5	$2\frac{1}{2}$
Length of Stroke,	4	2
Diameter of Propeller,	14	6
Length of "	4	0
Angle at Hub,	11°	
" Periphery,	48° and 45°	
Pitch " "	40 feet expanding to 45 feet	
Number of Blades,	4	
Area "	108 square feet.	
Average number of Revolutions,	estimated 30	
" Pressure of Steam,	" lbs. 15	
Cutting off at	—	
Three Copper Boilers (side by side).		
Whole amount of Fire Surface,	5250 square feet.	
" " Grate "	$195\frac{1}{2}$ "	
Ratio of Fire Surface to cubic foot of Cylinder,	$17\frac{3}{4}$ to 1.	
" " " Grate Surface	27 to 1.	
Area of 1st Flues,	35 square feet.	
" 2d "	35 "	
" 3d "	32 "	
" Chimney,	34 "	
Height of " above Grate,	65 feet.	
Consumption of Bituminous Coal per hour,	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

*Not yet finished.





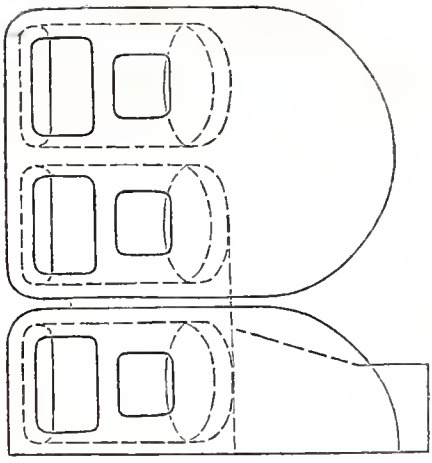
PRINCETON.

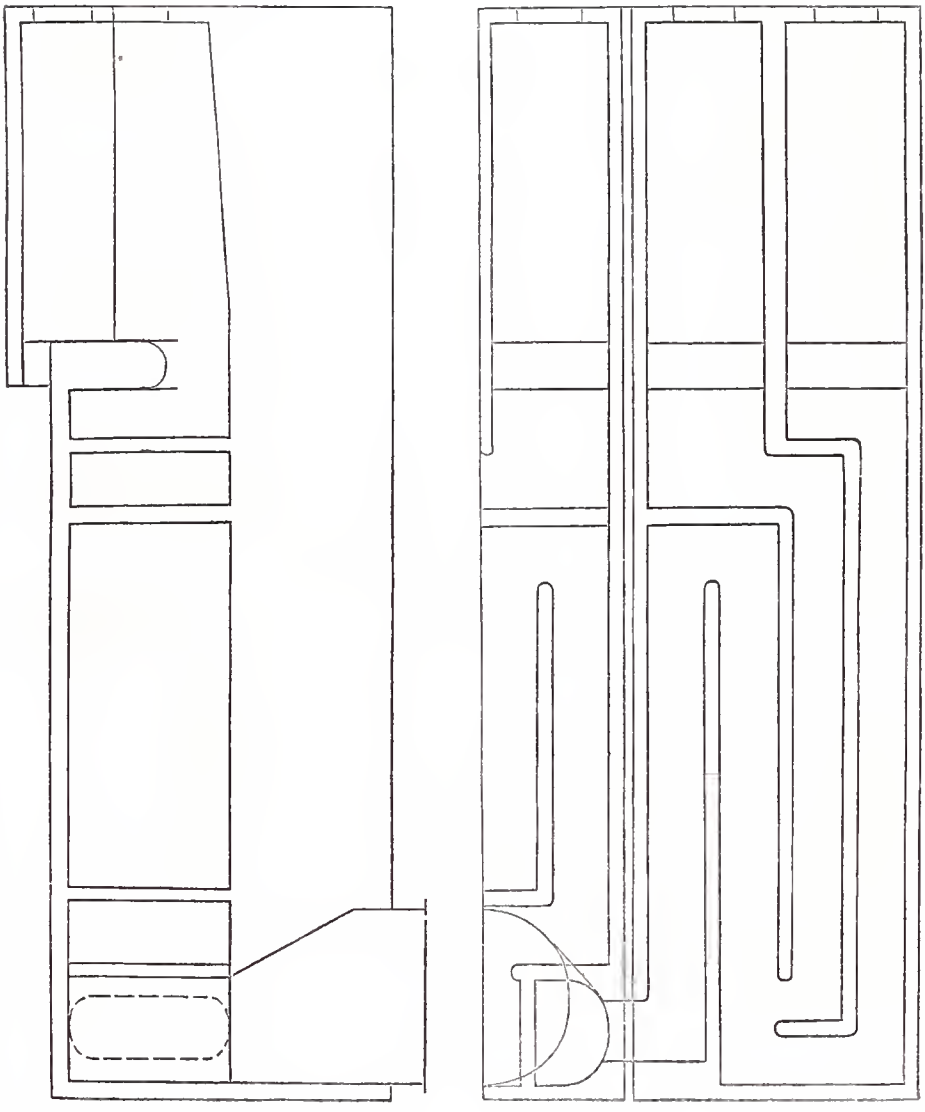
War Steamer belonging to the United States Navy. Engines designed by John Ericsson, Esq., and constructed by Merrick & Towne, of Philadelphia.

	Feet.	Inches.
Length on Deck,	165	2
Breadth of Beam,	30	
Depth of Hold,	21	8
Tonnage,	tons 663	
Average Draft of Water forward,	15 feet, aft, 18	6
Two Semi Cylinder Engines with Vibrating Pistons.		
Area of Cylinders, each	$17\frac{3}{4}$ square feet.	
Length of Stroke,	3	0
Diameter of Propeller,	14	0
Length of "	4	0
Angle at Hub,	8°	
" Periphery,	51°	
Pitch at "	35	0
Number of Blades,	6	
Area "	120 square feet.	
Average Number of Revolutions,*	23	
Average Pressure of Steam,	lbs. 13	
Cutting off at one-third stroke.		
Three Iron Boilers (side by side).		
Whole Amount of Fire Surface,	2420 square feet.	
" " Grate Surface,	134 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$23\frac{4}{10}$ to 1.	
" " " Grate Surface,	18 to 1.	
Area of 1st Flues,	$27\frac{1}{10}$ square feet.	
" 2d "	$15\frac{7}{10}$ "	
" Chimney,	$13\frac{6}{10}$ "	
Height of " above Grate,	32 feet	
Consumption of Anthracite Coal per hour,	1400 lbs.	
Water Evaporated by 1 lb. of Coal,	$4\frac{3}{10}$ "	
Coal per hour to a square foot of Grate,	$10\frac{1}{2}$ "	

Note.—Fan blast under grate.

* The above rate of speed was found to be most economical, and was the average at sea.





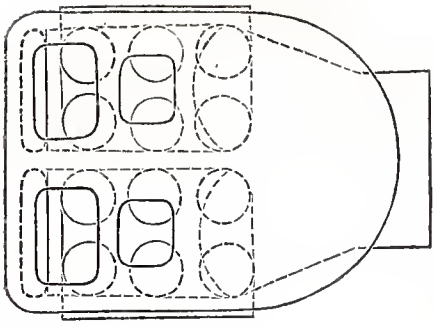
PRINCETON.*

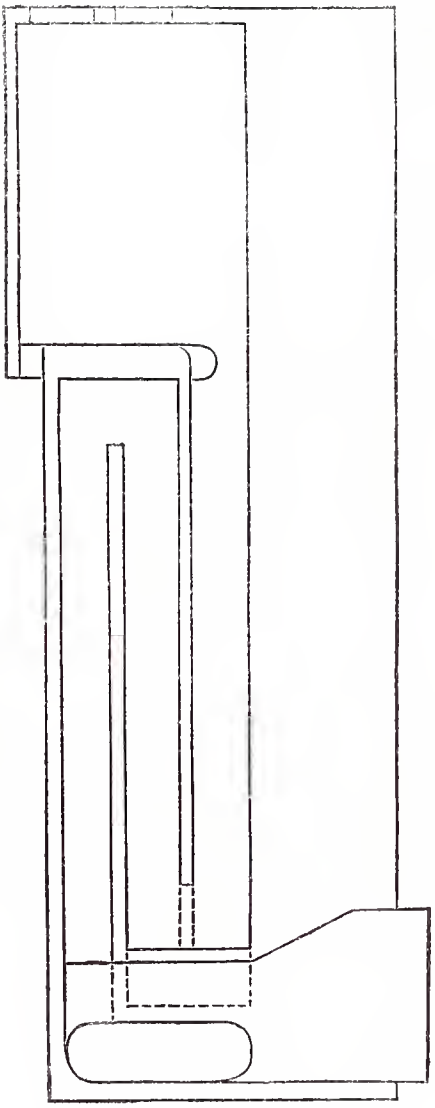
War Steamer, belonging to the United States Navy. Engines designed by John Ericsson, Esq., Boilers by Charles H. Haswell, Esq., Engineer in Chief, U. S. N., and Propeller by Robert L. Stevens, Esq.

		Feet.	Inches.
Length on Deck,		165	2
Breadth of Beam,		30	0
Depth of Hold,		21	8
Tonnage,	tons 663		
Average Draft of Water forward,	15 ft. 6 in., aft,	18	6
Two Semi-Cylinder Engines with Vibrating Pistons.			
Area of Cylinders, each	$17\frac{1}{3}$ sq. ft.		
Length of Stroke,		3	0
Diameter of Propeller,		14	0
Length of "		3	10
Angle at Hub,	—		
" Periphery,	52°		
Pitch at "		32	0
Number of Blades,	6		
Area of "	130 square feet.		
Average Number of Revolutions,†	25		
Average Pressure of Steam,	lbs. 12		
Cutting off at one-third stroke.			
Three Iron Boilers (side by side).			
Whole Amount of Fire Surface,	3000 square feet.		
" " Grate "	136 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$28\frac{8}{10}$ to 1.		
" " " Grate Surface,	22 to 1.		
Area of 1st Flues,	$18\frac{3}{10}$ square feet.		
" 2d and 3d Flues, each	$16\frac{3}{4}$ "		
" Chimney,	$13\frac{6}{10}$ "		
Height of " above Grate,	40 feet.		
Consumption of Anthracite Coal per hour,	1000 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{55}{100}$ lbs.		
Coal per hour to a square foot of Grate,	$7\frac{35}{100}$ "		

* With new Boilers and new Propeller.

† Most economical speed at sea.



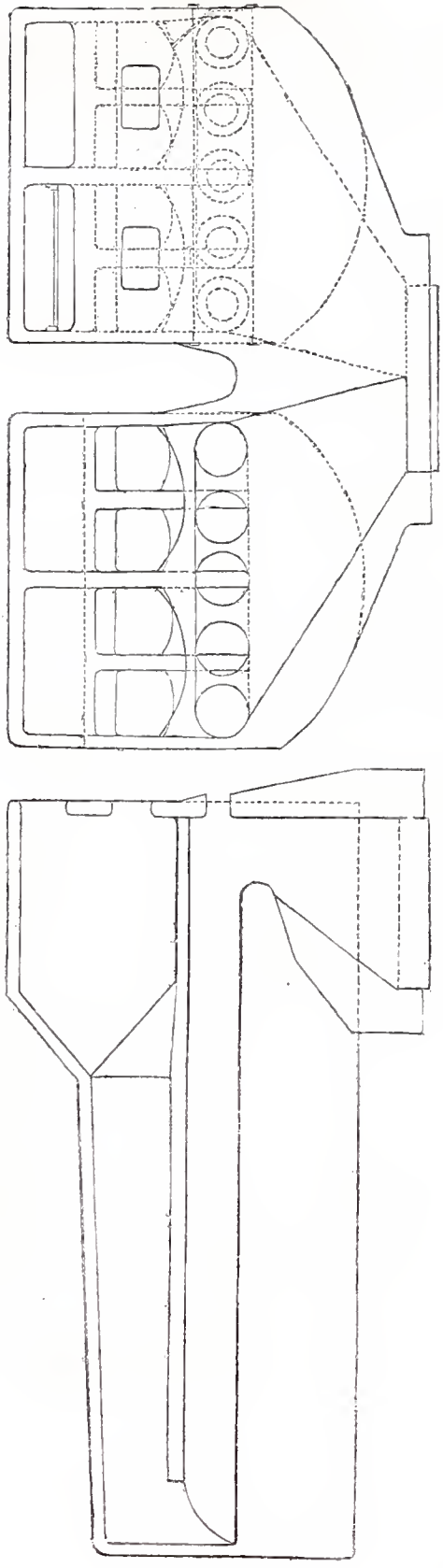


MICHIGAN.

Iron War Steamer, belonging to the United States Navy, on Lake Erie. Engines and Boilers designed by Charles W. Copeland, Esq., and constructed by Stackhouse & Tomlinson, of Pittsburg.

		Feet.	Inches.
Length on Deck,		168	0
Breadth of Beam,		27	0
Depth of Hold,		12	0
Tonnage,	tons 518		
Average Draft of Water,		7	8
Two Inclined Engines.			
Diameter of Cylinders,		3	0
Length of Stroke,		8	0
Diameter of Paddle Wheels,		21	10
Length of Paddles,	3 ft. 9 in. each, or	7	6
Depth of Double Paddles,	15 and 10 inches, or	2	1
Number in each Wheel,	2 setts of 16 each		
Average Dip of Wheel,		2	8
Average Number of Revolutions,	22		
Average Pressure of Steam,	lbs. 15		
Cutting off at		3	6
Two Iron Boilers (side by side).			
Whole Amount of Fire Surface,	1680 square feet.		
" " Grate "	85 "		
Ratio of Fire Surface to cubic foot of Cylinder,	15 to 1.		
" " " Grate Surface,	$19\frac{3}{4}$ to 1.		
Area of 1st Flues at back end,	20 square feet.		
" 2d "	$14\frac{9}{100}$ "		
" Chimney,	$14\frac{2}{100}$ "		
Height of " above Grate,	54 feet.		
Consumption of Bituminous Coal per hour,	1400 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{46}{100}$ lbs.		
Coal per hour to a square foot of Grate,	$16\frac{1}{2}$ "		

Note.—The paddles of the wheels are broken both in length and depth. There are two setts of 16 double paddles to each wheel.

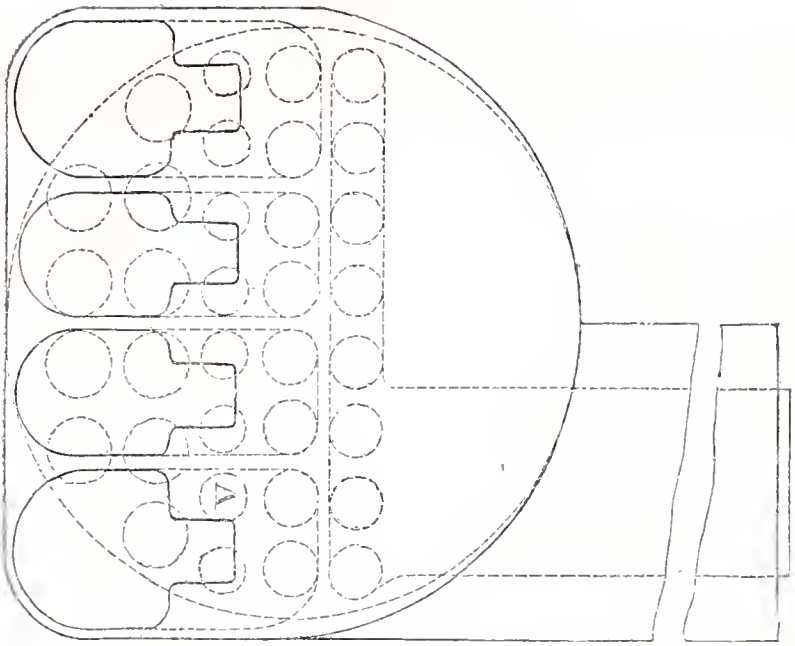


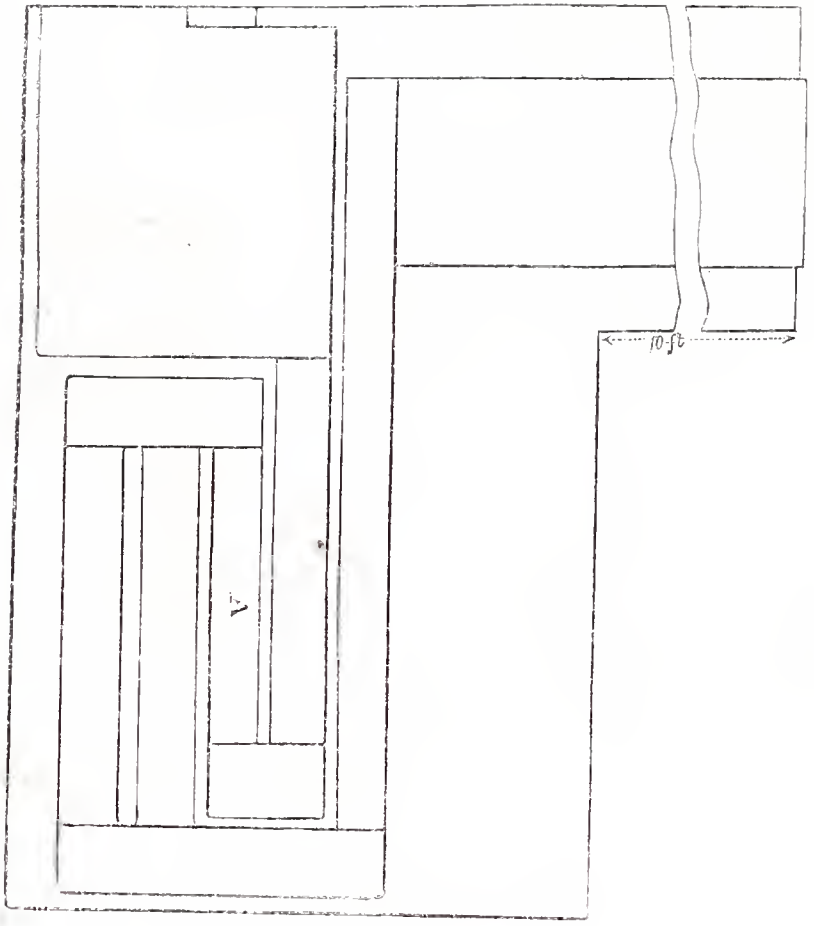
GEORGIA.

Merchant Steamer running between New York and New Orleans. Engines and Boilers designed and constructed by T. F. Secor & Co., New York.

		Feet.	Inches.
Length on Deck,		248	8
Breadth of Beam,		48	8½
Depth of Hold,		25	6
Tonnage,	tons 2695		
Average Draft of Water,		15	0
Two Side Lever Engines.			
Diameter of Cylinders,		7	6
Length of Stroke,		8	0
Diameter of Paddle Wheels,		36	0
Length of Paddles,		10	6
Depth of "		1	3
Number of Paddles in each Wheel,	32		
Average Dip of Wheel,		6	0
Average Number of Revolutions,	12		
Average Pressure of Steam,	lbs. 15		
Cutting off at		4	0
Four Iron Boilers, in pairs, two forward and two abaft the engines, with two chimnies.			
Whole Amount of Fire Surface,	9464 square feet.		
" " Grate "	426 "		
Ratio of Fire Surface to cubic foot of Cylinder,	13 to 1.		
" " " Grate Surface,	22¼ to 1.		
Area of 1st Flues,	44 6/10 square feet.		
" 2d "	39 "		
" 3d "	70 4/10 "		
" 4th "	42 "		
" Chimnies,	56 "		
Height of " above Grate,	75 feet.		
Consumption of Anthracite Coal per hour,	4480 lbs.		
Water Evaporated by 1 lb. of Coal,	7¾ lbs.		
Coal per hour to a square foot of Grate,	10½ "		

Note.—The Flues marked A are drawn too small. Their diameter is 15 inches.



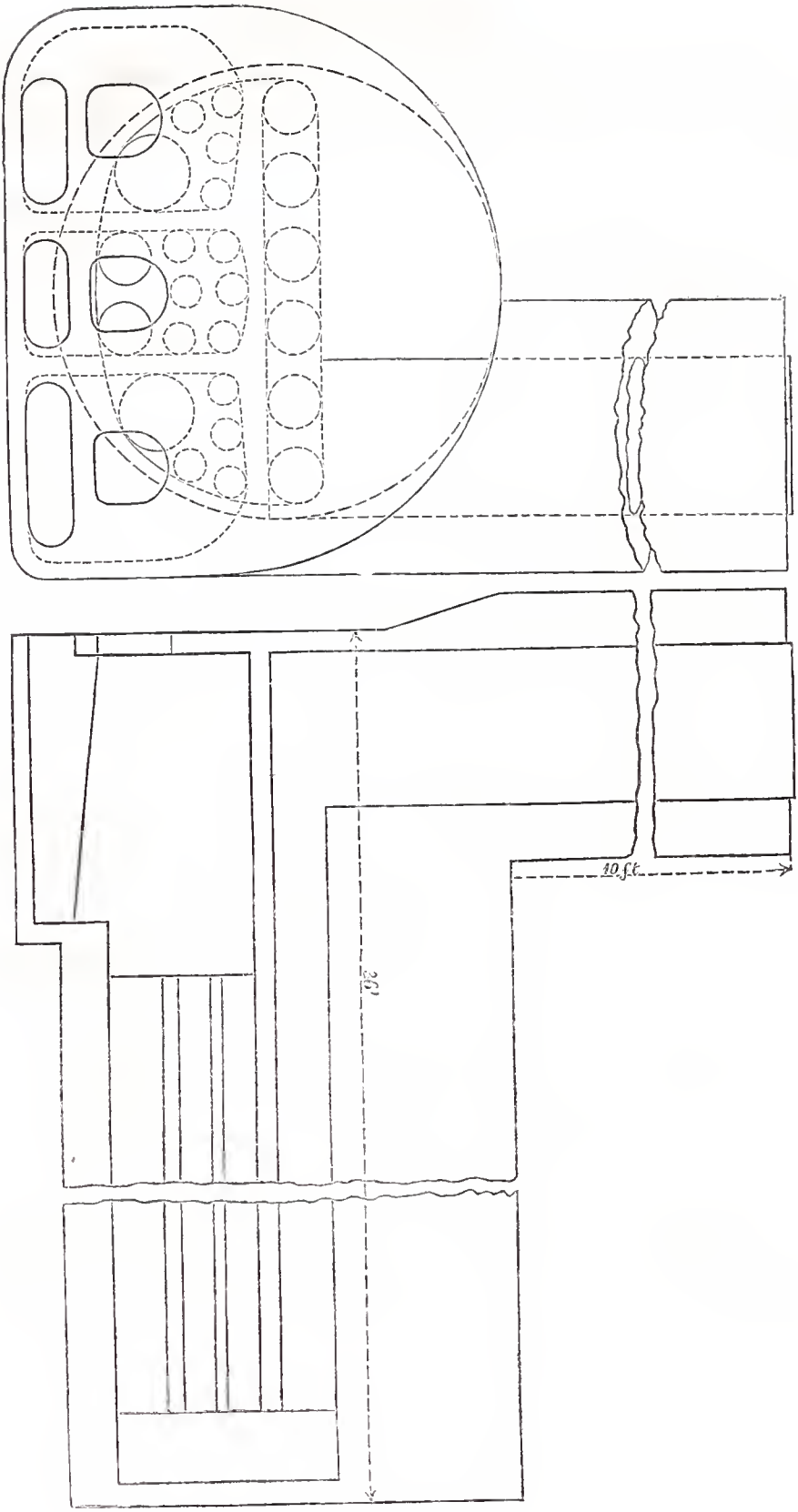

10-ft

WASHINGTON.

Merchant Steamer running between New York and Bremen. Engines and Boilers designed and constructed by Stillman, Allen & Co., New York.

		Feet.	Inches.
Length on Deck,		236	0
Breadth of Beam,		39	0
Depth of Hold,		31	0
Tonnage,	tons 1733		
Average Draft of Water,		19	6
Two Side Lever Engines.			
Diameter of Cylinders,		6	0
Length of Stroke,		10	0
Diameter of Paddle Wheels,		34	8
Length of Paddles,		7	6
Depth of "		3	4
Number of Paddles in each Wheel,	28		
Average Dip of Wheel,		6	4
Average Number of Revolutions,	11		
Average Pressure of Steam,	lbs. 12		
Cutting off at		3	4
Two Iron Boilers (side by side).			
Whole Amount of Fire Surface,	5760 square feet.		
" " Grate Surface,	182 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$10\frac{2}{10}$ to 1.		
" " " Grate Surface,	32 to 1.		
Area of 1st Flues,	36 square feet.		
" 2d "	$21\frac{1}{10}$ "		
" Chimney,	$33\frac{2}{10}$ "		
Height of " above Grate,	75 feet.		
Consumption of Bituminous Coal per hour,*	3920 lbs.		
Water Evaporated by 1 lb. of Coal,	$4\frac{77}{100}$ lbs.		
Coal per hour to a square foot of Grate,	23 "		

* Fan blast under grate.


10 ft.
22

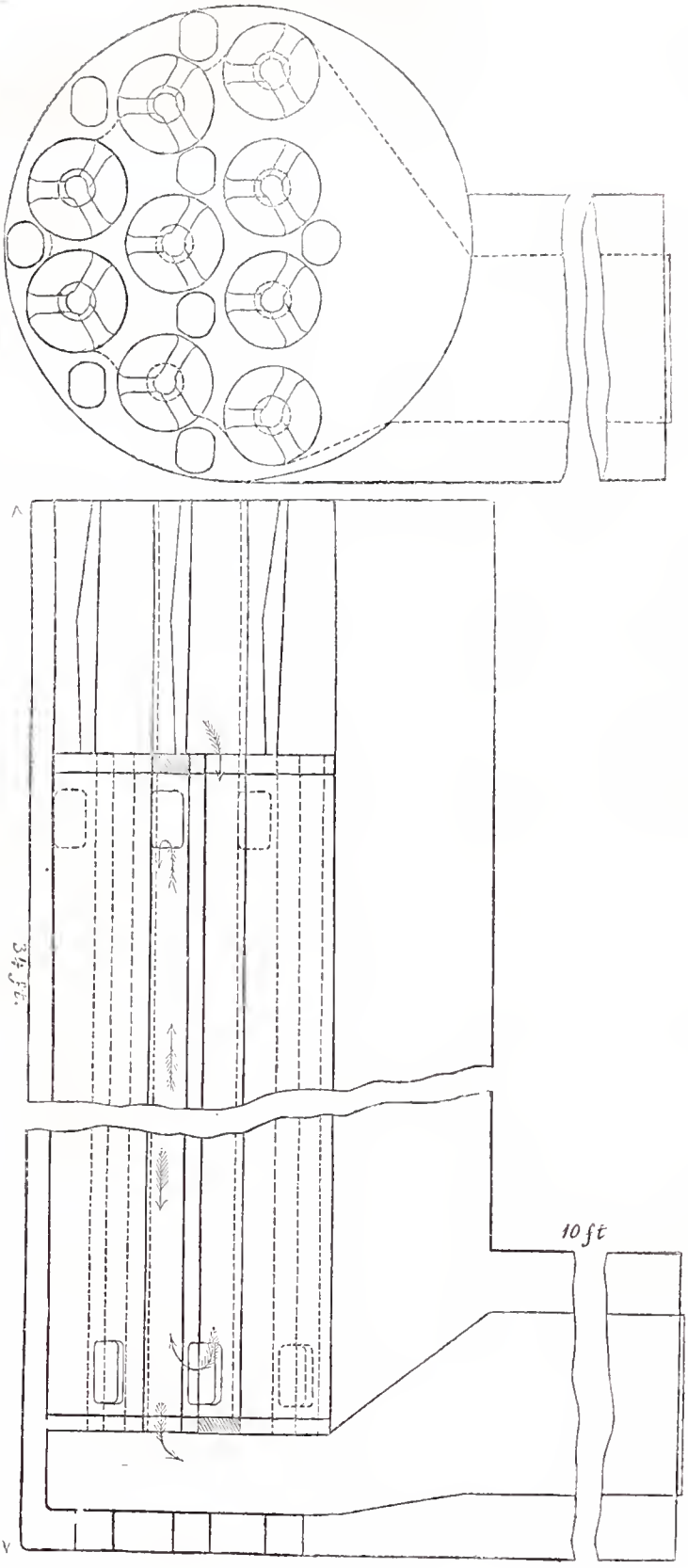
WASHINGTON.*

Merchant Steamer running between New York and Bremen. Engines and Boilers designed and constructed by Stillman, Allen & Co., New York.

	Feet.	Inches.
Length on Deck,	236	0
Breadth of Beam,	39	0
Depth of Hold,	31	0
Tonnage,	tons 1733	
Average Draft of Water,	19	6
Two Side Lever Engines.		
Diameter of Cylinders,	6	0
Length of Stroke,	10	0
Diameter of Paddle Wheels,	34	8
Length of Paddles,	7	6
Depth of Paddles,	3	4
Number of Paddles in each Wheel,	28	
Average Dip of Wheel,	6	4
" Number of Revolutions,	11	
" Pressure of Steam,	lbs. 14	
Cutting off at	3	0
Two Iron Boilers (side by side).†		
Whole Amount of Fire Surface,	6798 square feet.	
" " " Grate "	292 "	
Ratio of Fire Surface to cubic foot of Cylinder,	12 to 1.	
" " " Grate Surface,	$23\frac{1}{2}$ to 1.	
Area of 1st, 2d, and 3d Flues, each	$22\frac{1}{2}$ square feet.	
" Chimney,	$33\frac{2}{10}$ "	
Height of " above Grate,	75 feet.	
Consumption of Bituminous Coal per hour,	3080 lbs.	
Water Evaporated by 1 lb. of Coal,	$5\frac{32}{100}$ "	
Coal per hour to a square foot of Grate,	$10\frac{1}{2}$ "	

* With new boilers.

† The Boilers are on Miller's patent. In this case, the natural draft through the flues, as shown in section, not being sufficient, the draft was made direct through all the flues.


34 ft.
10 ft

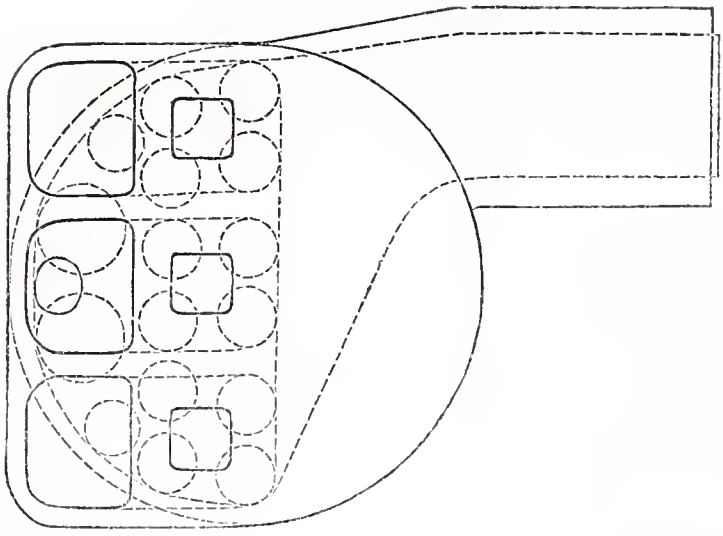
UNITED STATES.

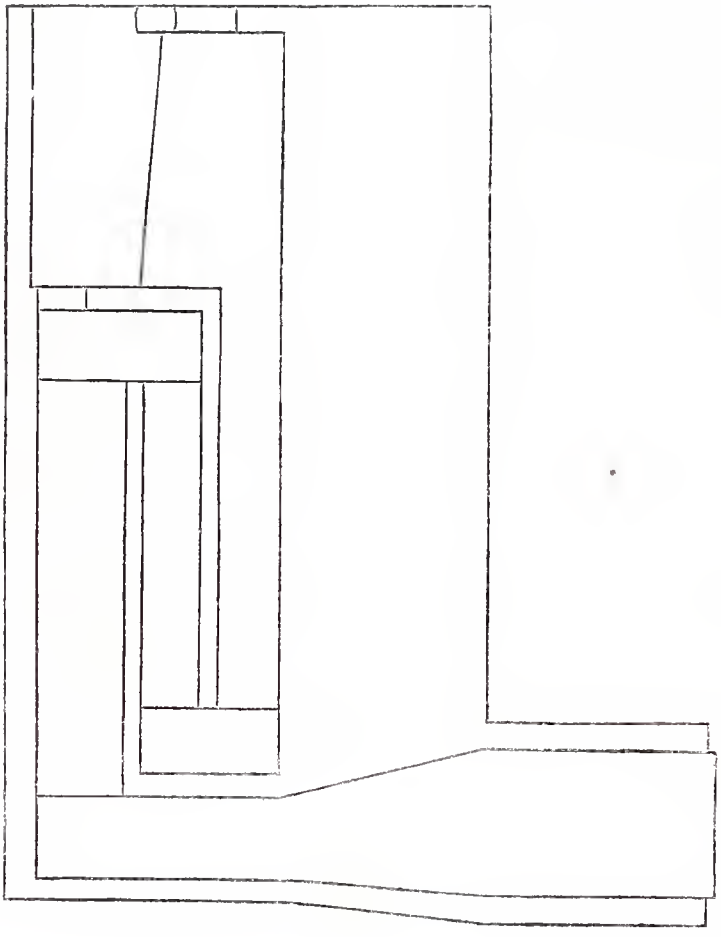
Merchant Steamer running from New York to Liverpool. Engines and Boilers designed and constructed by T. F. Secor & Co., New York.

		Feet.	Inches.
Length on Deck,		250	0
Breadth of Beam,		40	0
Depth of Hold,		31	0
Tonnage,	tons 1904		
Average Draft of Water,		15	9
Two Side Lever Engines.			
Diameter of Cylinders,		6	8
Length of Stroke,		9	0
Diameter of Paddle Wheels,		34	8
Length of Paddles,		8	6
Depth of "		2	6
Number of Paddles in each Wheel,	28		
Average Dip of Wheel,		5	0
Average Number of Revolutions,*	12		
Average Pressure of Steam,	lbs. 12		
Cutting off at		4	6
Four Iron Boilers (back to back).			
Whole Amount of Fire Surface,	5124 square feet.		
" " Grate "	234 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$8\frac{2}{10}$ to 1.		
" " " Grate Surface,	$21\frac{9}{10}$ to 1.		
Area of 1st, 2d, and 3d Flues, each	42 square feet.		
" Chimney,	42 "		
Height of " above Grate,	65 feet.		
Consumption of Anthracite Coal per hour,†	4400 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{8}{10}$ "		
Coal per hour to a square foot of Grate,	$18\frac{8}{10}$ "		

* Results from first passage to Liverpool.

† Fan blast under grate.



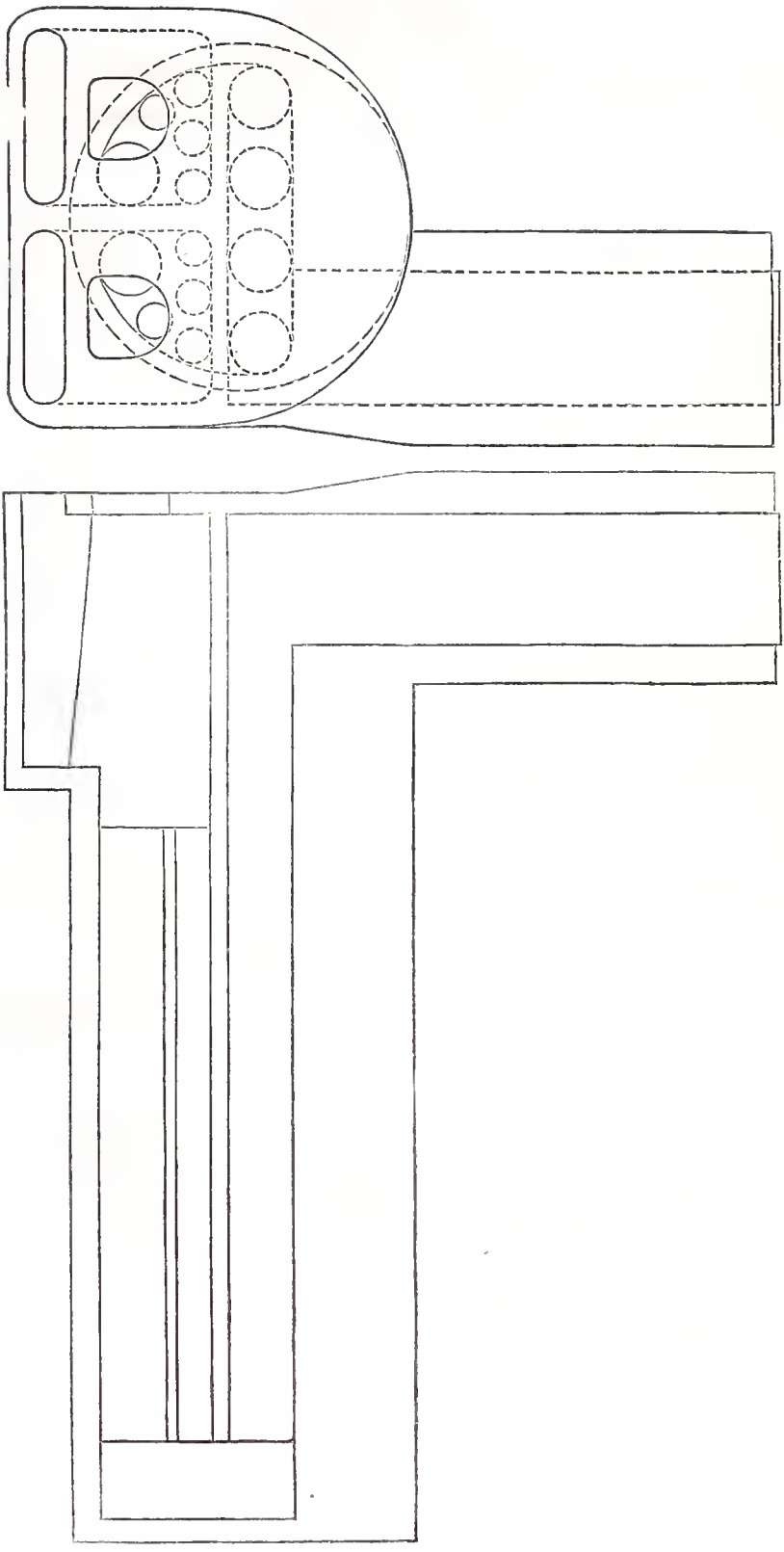


NORTHERNER.

Merchant Steamer running between New York and Charleston. Engine and boilers designed and constructed by Stillman, Allen & Co., of New York.

	Feet	Inches.
Length on Deck,	205	0
Breadth of Beam,	32	8
Depth of Hold,	22	6
Tonnage,	tons 1013	
Average Draft of Water,	12	
One Side Lever Engine.		
Diameter of Cylinder,	5	10
Length of Stroke,	8	0
Diameter of Paddle Wheels,	31	0
Length of Paddles,	7	6
Depth of "	2	6
Number of Paddles in each wheel,	24	
Average Dip of Wheel,	4	9
Average Number of Revolutions,	14	
Average Pressure of Steam,	lbs. 18	
Cutting off at	4	0
Two Iron Boilers (side by side).		
Whole Amount of Fire Surface,	2726 square feet.	
" " Grate "	110 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{3}{4}$ to 1.	
" " " Grate Surface	$24\frac{9}{10}$ to 1.	
Area of 1st Flues,	$18\frac{4}{10}$ square feet.	
" 2d "	$17\frac{6}{10}$ "	
" Chimney,	$16\frac{6}{10}$ "	
Height of " above Grate,	55 feet.	
Consumption of Anthracite Coal per hour,*	2240 lbs.	
Water Evaporated by 1 lb. of Coal,	6 "	
Coal per hour to a square foot of Grate,	$20\frac{4}{10}$ "	

* Fan blast under grate.

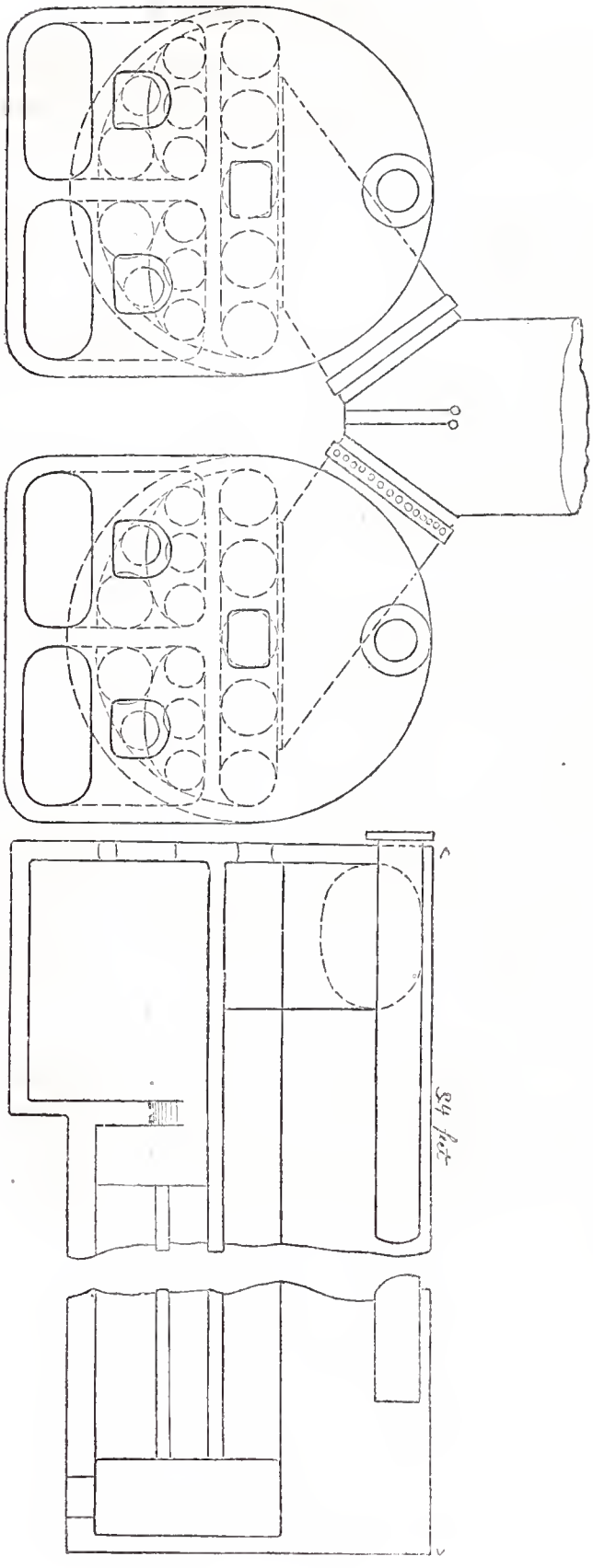


FALCON.

Merchant Steamer running between New York, Havana, and New Orleans. Engines and boilers designed and constructed by Hogg & Delamater, of New York.

		Feet.	Inches.
Length on Deck,		206	0
Breadth of Beam,		30	6
Depth of Hold,		21	0
Tonnage,	tons 878		
Average Draft of Water,		12	0
Two Inclined Engines.			
Diameter of Cylinders,		5	0
Length of Stroke,		5	0
Diameter of Paddle Wheels,		32	0
Length of Paddles,		7	9
Depth of "		1	3
Number of Paddles in each Wheel,	24		
Average Dip of Wheel,		5	0
Average Number of Revolutions,	15		
Average Pressure of Steam,	lbs. 14		
Cutting off at		2	6
Two Iron Boilers (side by side).			
Whole Amount of Fire Surface,	2500 square feet.		
" " Grate Surface,	101 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{3}{4}$ to 1.		
" " " Grate Surface,	$24\frac{1}{2}$ to 1.		
Area of 1st Flues,	$20\frac{8}{10}$ square feet.		
" 2d "	18 "		
" Chimney,	21 "		
Height of " above Grate,	65 feet		
Consumption of Bituminous Coal per hour,*	2240 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{1}{2}$ "		
Coal per hour to a square foot of Grate,	$22\frac{1}{10}$ "		

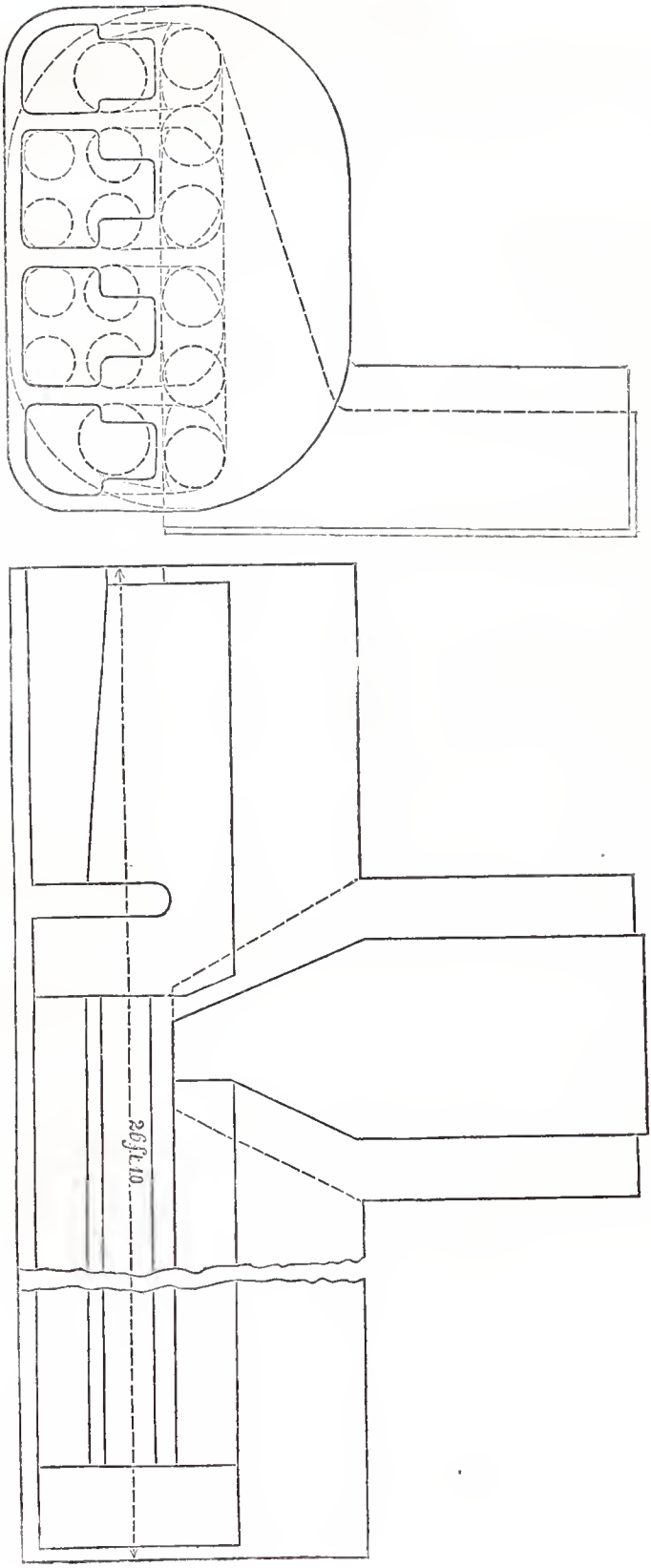
* Fan blast under grate.


84 feet

PHILADELPHIA.

Merchant Steamer running between New York and Chagres. Engines and boilers designed and constructed by Merrick & Towne, of Philadelphia.

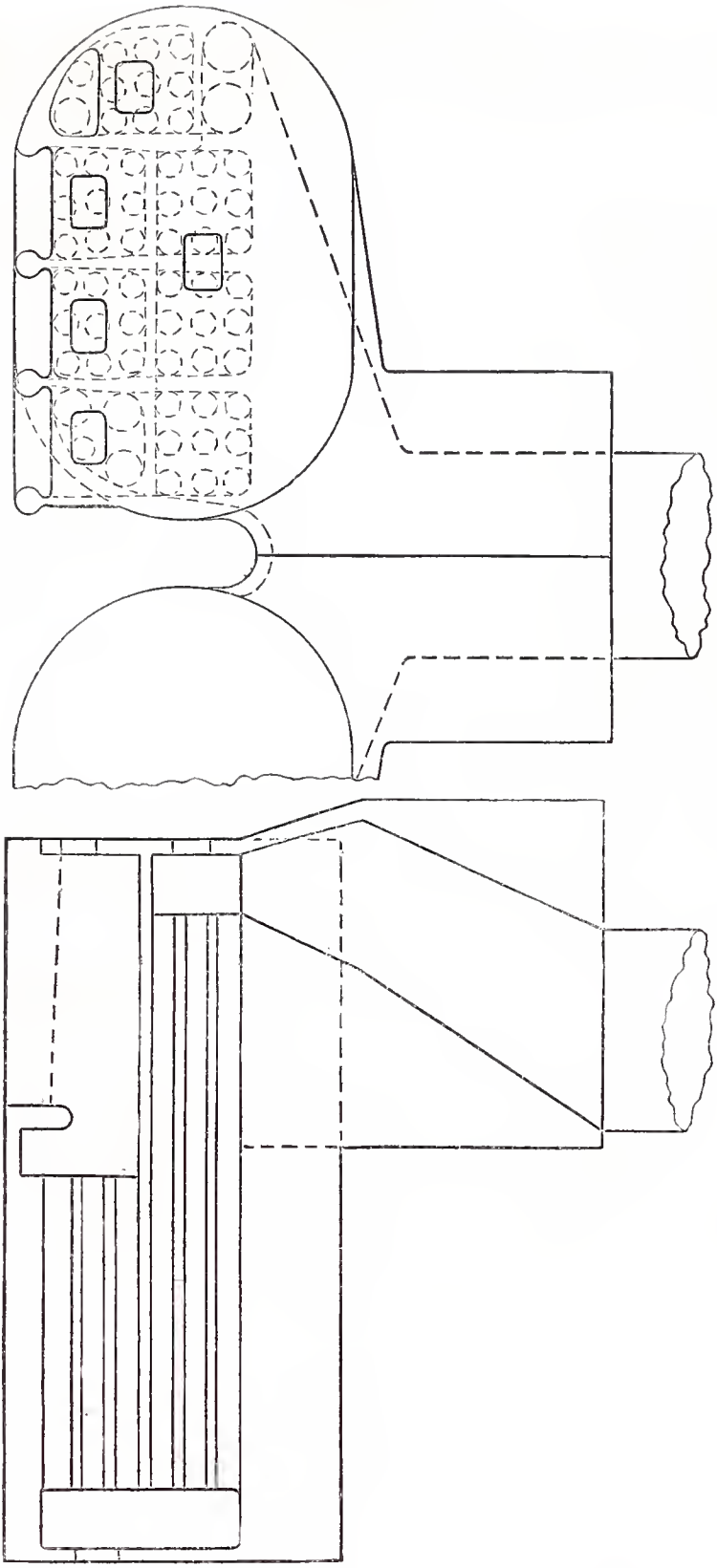
		Feet.	Inches.
Length on Deck,		190	0
Breadth of Beam,		33	0
Depth of Hold,		18	3
Tonnage,	tons 974		
Average Draft of Water,		10	6
Two Side Lever Engines.			
Diameter of Cylinders,		4	8
Length of Stroke,		6	9
Diameter of Paddle Wheels,		27	0
Length of Paddles,		8	6
Depth of "		2	6
Number of Paddles in each Wheel,	24		
Average Dip of Wheel,		4	0
Average Number of Revolutions,	15		
Average Pressure of Steam,	lbs. 15		
Cutting off at		3	$4\frac{1}{2}$
Two Iron Boilers (side by side).			
Whole Amount of Fire Surface,	3390 square feet.		
" " Grate "	155 "		
Ratio of Fire Surface to cubic foot of Cylinder,	15 to 1.		
" " " Grate Surface,	21 to 1.		
Area of 1st Flues,	33 square feet.		
" 2d "	23 "		
" Chimney,	24 "		
Height of " above Grate,	63 feet.		
Consumption of Anthracite Coal per hour,	2000 lbs.		
Water Evaporated by 1 lb. of Coal,	$7\frac{2}{10}$ lbs.		
Coal per hour to a square foot of Grate,	$12\frac{9}{10}$ "		


26ft.10

REPUBLIC.

Merchant Steamer running between Panama and San Francisco. Engines and boilers designed and constructed by Murry & Hazlehurst, of Baltimore.

	Feet.	Inches.
Length on Deck,	207	0
Breadth of Beam,	30	0
Depth of Hold,	18	6
Tonnage, tons 862		
Average Draft of Water,	11	9
Two Oscillating Engines.		
Diameter of Cylinders,	4	6
Length of Stroke,	6	0
Diameter of Paddle Wheels,	25	6
Length of Paddles,	8	9
Depth of Double Paddles, 14 inches each, or	2	4
Number of Double Paddles in each Wheel, 21		
Average Dip of Wheel,	3	2
Average Number of Revolutions, 14		
Average Pressure of Steam, lbs. 12		
Cutting off at	4	0
Two Iron Boilers (side by side).		
Whole Amount of Fire Surface, 3816 square feet.		
" " Grate " 123 "		
Ratio of Fire Surface to cubic foot of Cylinder, 20 to 1.		
" " " Grate Surface, 31 to 1.		
Area of 1st Flues, $22\frac{1}{4}$ square feet.		
" 2d " 21 "		
" Chimney, 20 "		
Height of " above Grate, 50 feet.		
Consumption of Anthracite Coal per hour, 1960 lbs.		
Water Evaporated by 1 lb. of Coal, $6\frac{85}{100}$ lbs.		
Coal per hour to a square foot of Grate, $15\frac{9}{10}$ "		



OHIO.

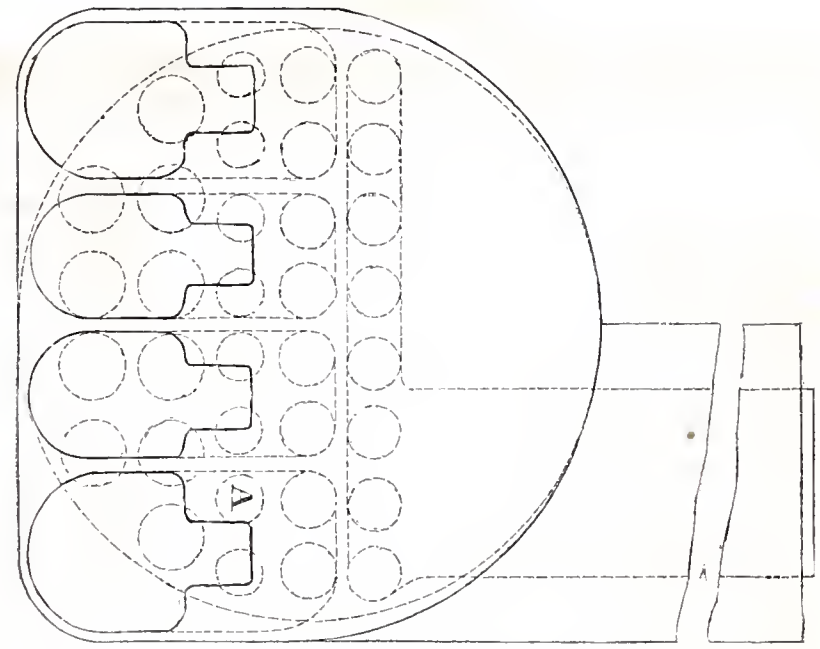
Merchant Steamer running between New York and New Orleans. Engines and Boilers designed and constructed by T. F. Secor & Co., New York.

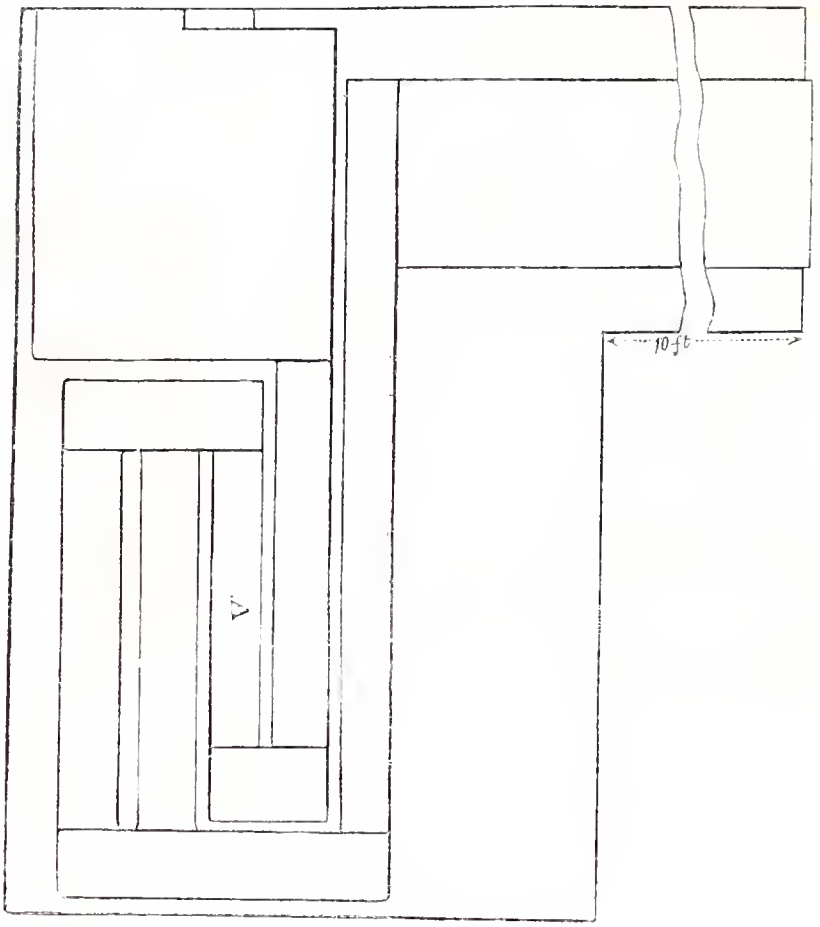
		Feet.	Inches.
Length on Deck,		247	10
Breadth of Beam,		45	7
Depth of Hold,		24	6
Tonnage,	tons 2397		
Average Draft of Water,		15	6
Two Side Lever Engines.			
Diameter of Cylinders,		7	6
Length of Stroke,		8	0
Diameter of Paddle Wheels,		36	0
Length of Paddles,		10	6
Depth of "		1	3
Number of Paddles in each Wheel,	32		
Average Dip of Wheel,		6	6
Average Number of Revolutions,	12		
Average Pressure of Steam,	lbs. 15		
Cutting off at		4	0

Four Iron Boilers, in pairs, two forward and two abaft the engines, with two chimnies.

Whole Amount of Fire Surface,	9464 square feet.
" " Grate "	426 "
Ratio of Fire Surface to cubic foot of Cylinder,	13 to 1.
" " " Grate Surface,	$22\frac{1}{4}$ to 1.
Area of 1st Flues,	$44\frac{6}{10}$ square feet.
" 2d "	39 "
" 3d "	$70\frac{4}{10}$ "
" 4th "	42 "
" Chimnies,	56 "
Height of " above Grate,	75 feet.
Consumption of Anthracite Coal per hour,	4480 lbs.
Water Evaporated by 1 lb. of Coal,	$7\frac{3}{4}$ lbs.
Coal per hour to a square foot of Grate,	$10\frac{1}{2}$ "

Note.—The Flues marked A are drawn too small. Their diameter is 15 inches.


A
A

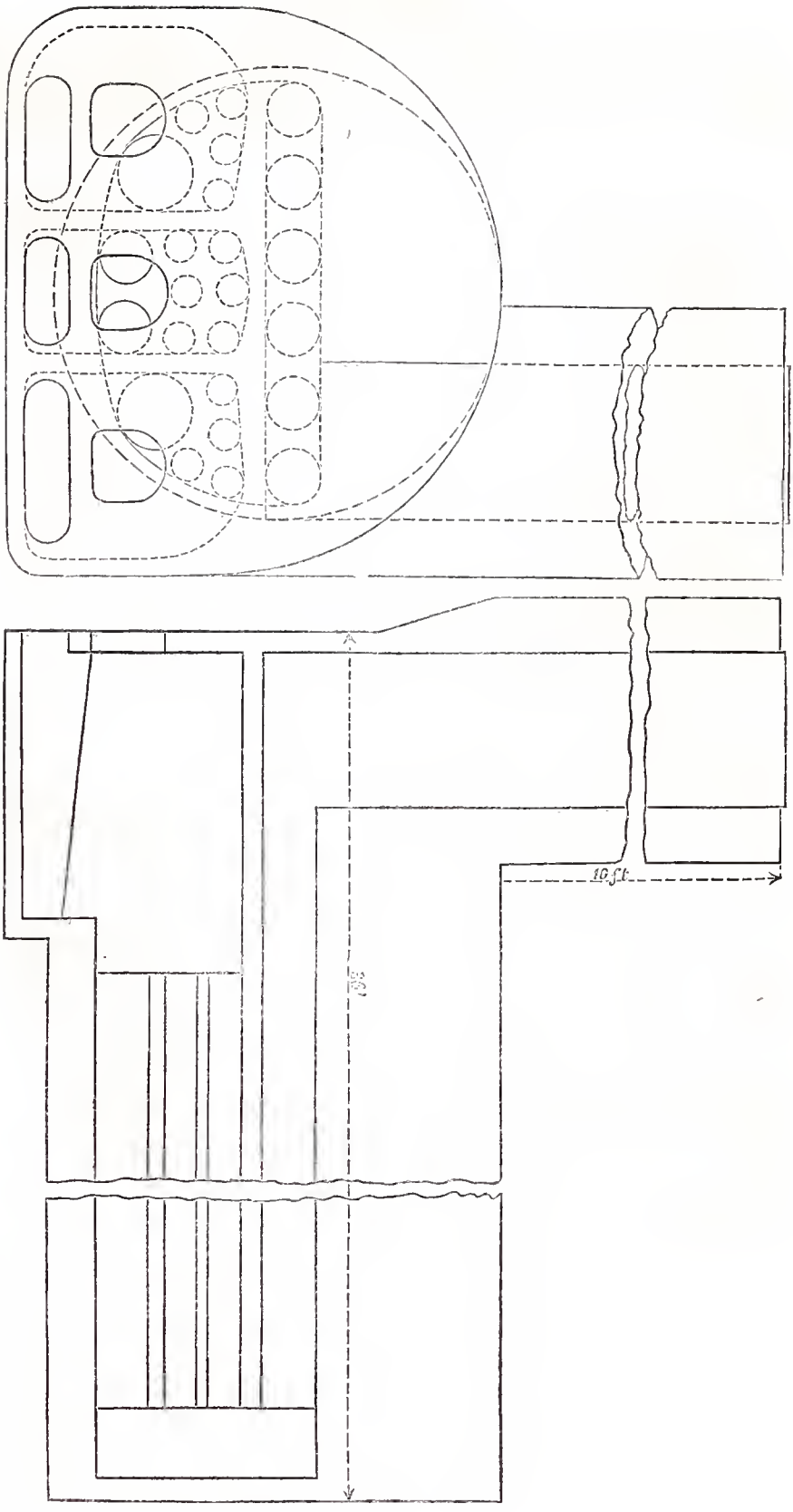

10 ft
A

HERMANN.

Merchant Steamer running between New York and Bremen. Engines and Boilers designed and constructed by Stillman, Allen & Co., New York.

		Feet.	Inches.
Length on Deck,		240	0
Breadth of Beam,		40	0
Depth of Hold,		31	0
Tonnage,	tons 1819		
Average Draft of Water,		19	6
Two Side Lever Engines.			
Diameter of Cylinders,		6	0
Length of Stroke,		10	0
Diameter of Paddle Wheels,		36	0
Length of Paddles,		8	0
Depth of "	18 inches each, or	3	0
Number of Double Paddles in each Wheel,	28		
Average Dip of Wheel,		7	6
Average Number of Revolutions,	11		
Average Pressure of Steam,	lbs. 12		
Cutting off at		3	4
Two Iron Boilers (side by side).			
Whole Amount of Fire Surface,	5760 square feet.		
" " Grate Surface,	182 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$10\frac{2}{10}$ to 1.		
" " " Grate Surface,	32 to 1.		
Area of 1st Flues,	36 square feet.		
" 2d "	$21\frac{1}{10}$ "		
" Chimney,	$33\frac{2}{10}$ "		
Height of " above Grate,	75 feet.		
Consumption of Bituminous Coal per hour,*	3920 lbs.		
Water Evaporated by 1 lb. of Coal,	$4\frac{77}{100}$ lbs.		
Coal per hour to a square foot of Grate,	$21\frac{1}{2}$ "		

* Fan blast under grate.


10 ft.

HERMANN.*

Merchant Steamer running between New York and Bremen. Engines by Stillman, Allen & Co.; Boilers designed by Erastus W. Smith, Esq., and constructed by Mott & Ayres, New York.

		Feet.	Inches.
Length on Deck,		241	0
Breadth of Beam,		40	0
Depth of Hold,		31	0
Tonnage,	tons	1819	
Average Draft of Water,		19	6
Two Side Lever Engines.			
Diameter of Cylinders,		6	0
Length of Stroke,		10	0
Diameter of Paddle Wheels,		36	0
Length of Paddles,		8	0
Depth of Paddles,		2	2
Number of Paddles in each Wheel,		28	
Average Dip of Wheel,		7	6
" Number of Revolutions,		12	
" Pressure of Steam,	lbs.	12	
Cutting off at		3	6
Four Iron Boilers, with 2 Chimnies.			
Whole Amount of Fire Surface,		8352	square feet.
" " " Tube "		5776	"
" " " Grate "		273	"
Ratio of Fire Surface to cubic foot of Cylinder,		$14\frac{8}{10}$	to 1.
" " " Grate Surface,		$30\frac{6}{10}$	to 1.
Area of Tubes,		39	square feet.
" Chimnies,		$47\frac{1}{2}$	"
Height of " above Grate,		75	feet.
Consumption of Bituminous Coal per hour,		3546	lbs.
Water Evaporated by 1 lb. of Coal,		$5\frac{5}{10}$	"
Coal per hour to a square foot of Grate,		13	"

* With new boilers.

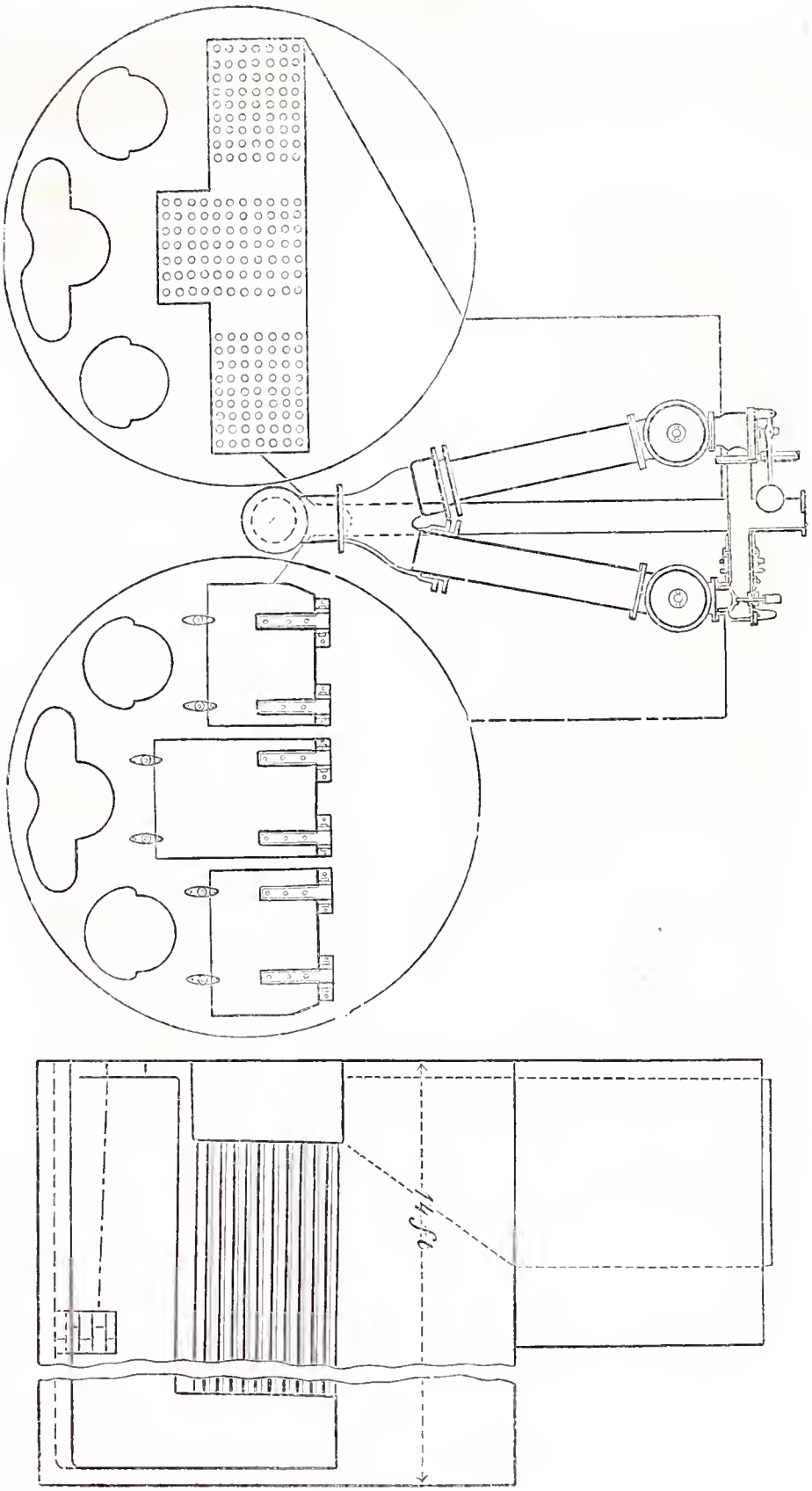


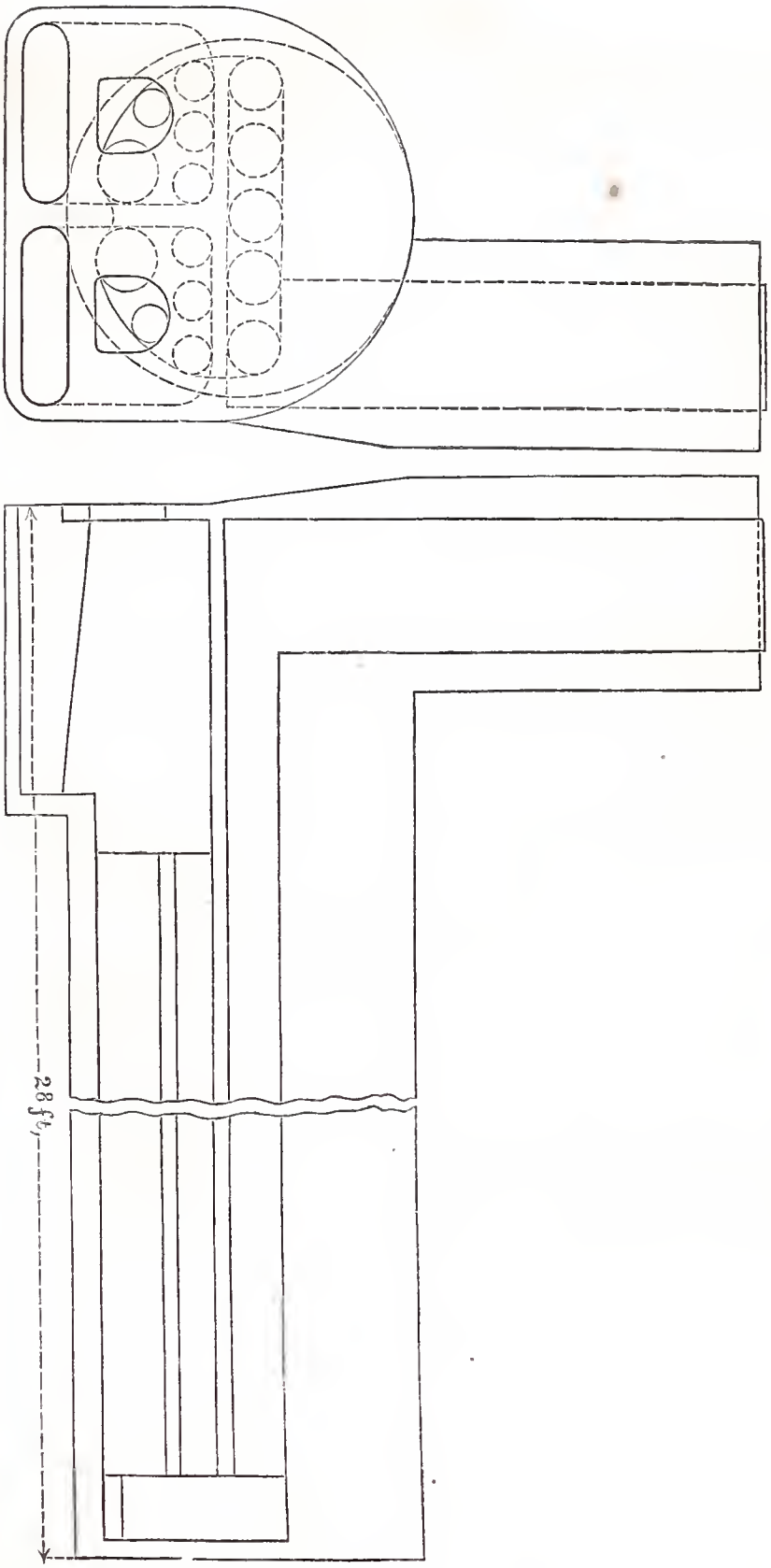
Fig. 2.

CHEROKEE.

Merchant Steamer running between New York and Chagres. Engine and Boilers designed and constructed by Stillman, Allen & Co., New York.

	Feet.	Inches.
Length on Deck,	210	0
Breadth of Beam,	35	2
Depth of Hold,	22	0
Tonnage, tons 1241		
Average Draft of Water,	13	0
One Side Lever Engine.		
Diameter of Cylinder,	6	3
Length of Stroke,	8	0
Diameter of Paddle Wheels,	31	4
Length of Paddles,	8	0
Depth of " 15 inches each, or	2	6
Number of Paddles in each Wheel, 24		
Average Dip of Wheel,	5	0
Average Number of Revolutions, 15		
Average Pressure of Steam, lbs. 16		
Cutting off at	4	0
Two Iron Boilers (side by side).		
Whole Amount of Fire Surface,	2986 square feet.	
" " Grate "	126 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{17}{100}$ to 1.	
" " " Grate Surface,	$23\frac{7}{10}$ to 1.	
Area of 1st Flues,	$21\frac{4}{10}$ square feet.	
" 2d "	16 "	
" Chimney,	$17\frac{1}{2}$ "	
Height of " above Grate,	55 feet.	
Consumption of Anthracite Coal per hour,*	2400 lbs.	
Water Evaporated by 1 lb. of Coal,	$6\frac{33}{100}$ "	
Coal per hour to a square foot of Grate,	16 "	

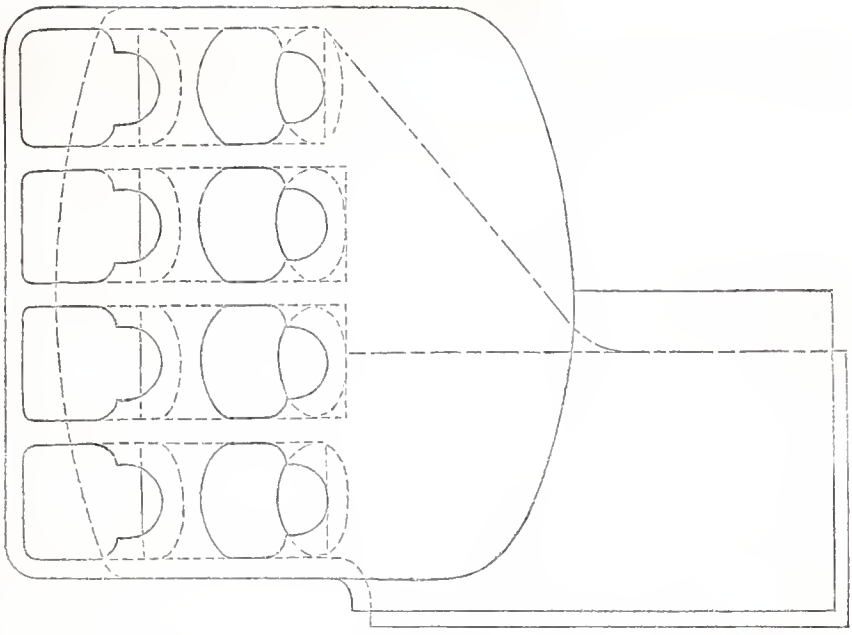
* Fan blast under grate.


28 ft.

ATLANTIC.

Merchant Steamer running between New York and Liverpool. Engines designed and constructed by Stillman, Allen & Co., of New York; boilers by John Faron, Esq., Chief Engineer of the Line.

	Feet.	Inches.
Length on Deck,	285	0
Breadth of Beam,	45	8
Depth of Hold,	32	0
Tonnage,	tons 2772	
Average Draft of Water,	19	0
Two Side Lever Engines.		
Diameter of Cylinders,	7	11
Length of Stroke,	9	0
Diameter of Paddle Wheels,	35	0
Length of Paddles,	12	4
Depth of "	2	2
Number of Paddles in each Wheel,	36	
Average Dip of Wheel,	7	2
Average Number of Revolutions,	$13\frac{1}{2}$	
Average Pressure of Steam,	lbs. 14	
Cutting off at	4	0
Four Iron Boilers (back to back); tubes 2 in. diameter outside.		
Whole Amount of Fire Surface,	19,044 square feet.	
" " Tube "	13,560 "	
" " Grate "	572 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$21\frac{1}{2}$ to 1.	
" " " Grate Surface	$33\frac{1}{4}$ to 1.	
Area of space between tubes in front,	111 square feet.	
" " " " at back,	$73\frac{1}{2}$ "	
" Chimney,	63 "	
Height of " above Grate,	75 feet.	
Consumption of Bituminous Coal per hour,	5880 lbs.	
Water Evaporated by 1 lb. of Coal,	$7\frac{1}{2}$ "	
Coal per hour to a square foot of Grate,	$10\frac{3}{10}$ "	



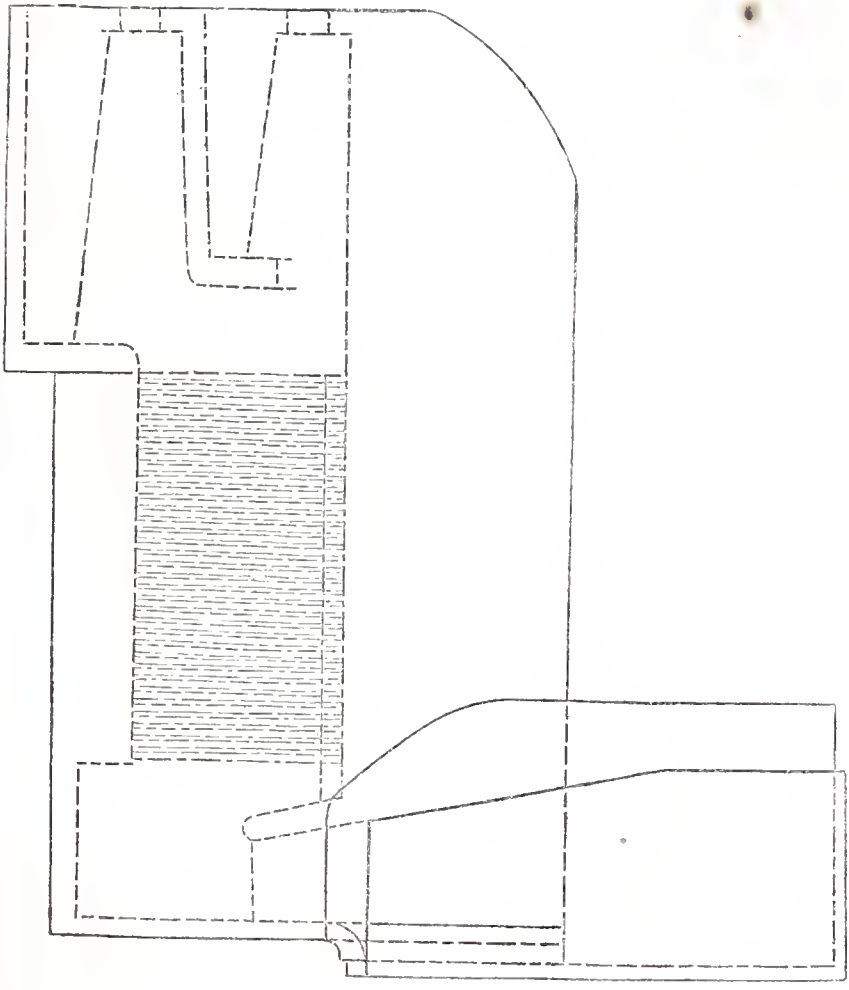


Fig. 3 shows a cross section of boiler at back connexion.

Fig. 4, plan of furnaces and tubes.

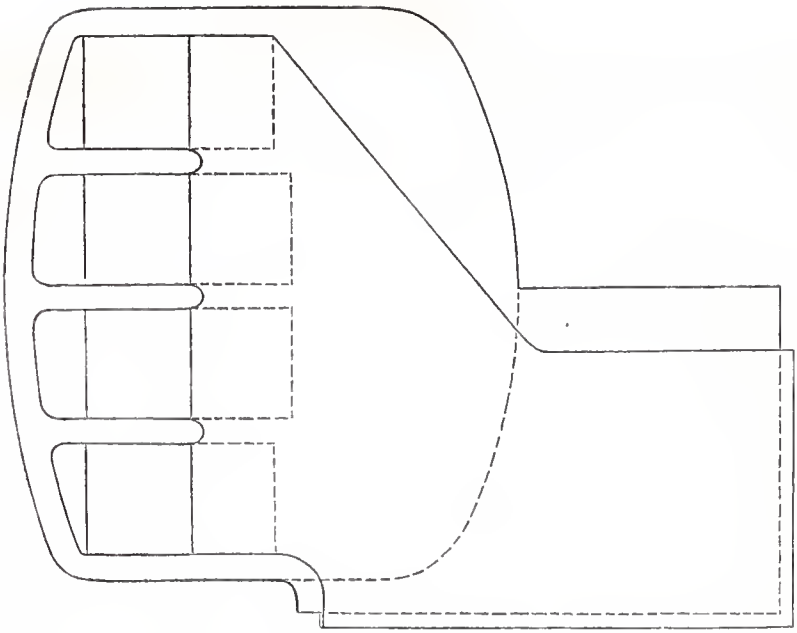


Fig. 3.

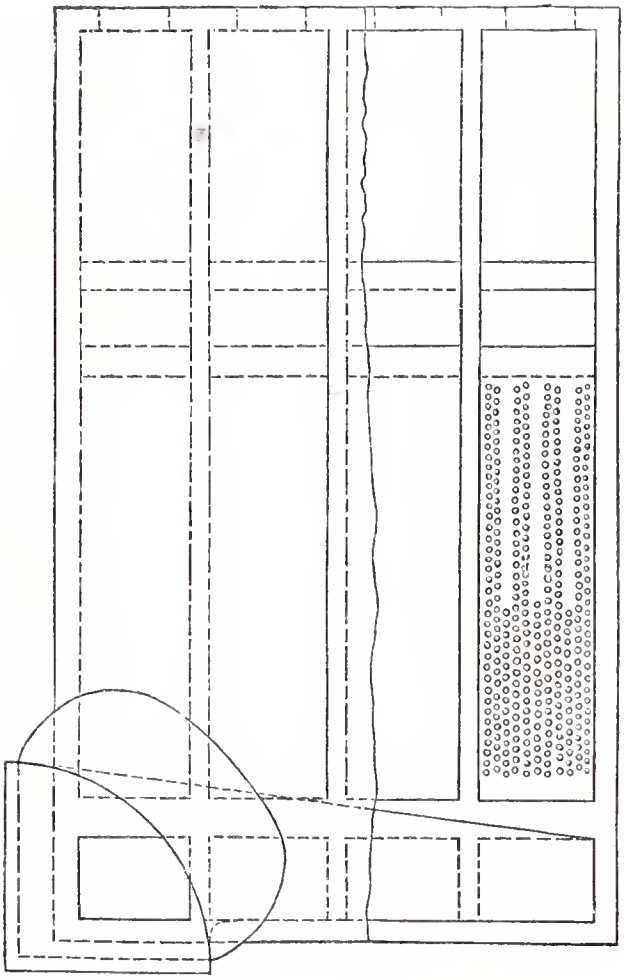


Fig. 4.

PACIFIC.

Merchant Steamer running between New York and Liverpool. Engines designed and constructed by the Allaire Works, New York; boilers by John Faron, Esq., Chief Engineer of the Line.

	Feet.	Inches.
Length on Deck,	282	0
Breadth of Beam,	45	0
Depth of Hold,	32	0
Tonnage,	tons 2686	
Average Draft of Water,	19	0
Two Side Lever Engines.		
Diameter of Cylinders,	7	11
Length of Stroke,	9	0
Diameter of Paddle Wheels,	36	0
Length of Paddles,	11	8
Depth of "	2	2
Number of Paddles in each Wheel,	28	
Average Dip of Wheel,	7	0
Average Number of Revolutions,	$13\frac{1}{2}$	
Average Pressure of Steam,	lbs. 14	
Cutting off at	4	0

Four Iron Boilers (back to back); tubes 2 in. diameter outside.

Whole Amount of Fire Surface,	19,044 square feet.
" " Tube Surface,	13,560 "
" " Grate Surface,	572 "
Ratio of Fire Surface to cubic foot of Cylinder,	$21\frac{1}{2}$ to 1.
" " " Grate Surface,	$33\frac{1}{4}$ to 1.
Area of space between tubes in front,	111 square feet.
" " " " at back,	$73\frac{1}{2}$ "
" Chimney,	$63\frac{1}{2}$ "
Height of " above Grate,	75 feet.
Consumption of Bituminous Coal per hour,	5880 lbs.
Water Evaporated by 1 lb. of Coal,	$7\frac{1}{2}$ "
Coal per hour to a square foot of Grate,	$10\frac{3}{10}$ "

Boilers of the same size and kind as those of the Atlantic.

BALTIC.

Merchant Steamer running between New York and Liverpool. Engines designed and constructed by the Allaire Works, New York; boilers by John Faron, Esq., Chief Engineer of the Line.

	Feet.	Inches.
Length on Deck,	283	6
Breadth of Beam,	45	0
Depth of Hold,	32	0
Tonnage,	tons 2718	
Average Draft of Water,	19	0
Two Side Lever Engines.		
Diameter of Cylinders,	7	11
Length of Stroke,	10	0
Diameter of Paddle Wheels,	36	0
Length of Paddles,	12	3
Depth of "	2	3
Number of Paddles in each Wheel,	32	
Average Dip of Wheel,	7	0
Average Number of Revolutions,	$13\frac{3}{4}$	
Average Pressure of Steam,	lbs. 14	
Cutting off at	4	6
Four Iron Boilers (back to back); tubes 2 in. diameter outside.		
Whole Amount of Fire Surface,	21,116 square feet.	
" " Tube "	15,066 "	
" " Grate "	635 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$21\frac{1}{2}$ to 1.	
" " " Grate Surface,	$33\frac{1}{4}$ to 1.	
Area of space between tubes in front,	122 square feet.	
" " " " at back,	81 "	
" Chimney,	$63\frac{1}{2}$ "	
Height of " above Grate,	75 feet.	
Consumption of Bituminous Coal per hour,	6615 lbs.	
Water Evaporated by 1 lb. of Coal,	$7\frac{1}{2}$ lbs.	
Coal per hour to a square foot of Grate,	$10\frac{3}{10}$ "	

Boilers of the same kind as the Atlantic's, but wider, and containing one-ninth more fire surface.

ARCTIC.

Merchant Steamer running between New York and Liverpool. Engines designed and constructed by Stillman, Allen & Co., New York; boilers by John Faron, Esq.,* Chief Engineer of the Line.

	Feet.	Inches.
Length on Deck,	286	0
Breadth of Beam,	45	8
Depth of Hold,	32	0
Tonnage,	tons 2772	
Average Draft of Water,	19	0
Two Side Lever Engines.		
Diameter of Cylinders,	7	11
Length of Stroke,	10	0
Diameter of Paddle Wheels,	35	6
Length of Paddles,	12	2
Depth of "	2	2
Number of Paddles in each Wheel,	36	
Average Dip of Wheel,	7	5
Average Number of Revolutions,	$13\frac{3}{4}$	
Average Pressure of Steam,	lbs. 14	
Cutting off at	4	6

Four Iron Boilers (back to back); tubes 2 in. diameter outside.

Whole Amount of Fire Surface,	21,160 square feet.
" " Tube "	15,066 "
" " Grate "	635 "
Ratio of Fire Surface to cubic foot of Cylinder,	$21\frac{1}{2}$ to 1.
" " " Grate Surface,	$33\frac{1}{4}$ to 1.
Area of space between tubes in front,	122 square feet.
" " " " at back,	81 "
" Chimney,	$63\frac{1}{2}$ "
Height of " above Grate,	75 feet.
Consumption of Bituminous Coal per hour,	6615 lbs.
Water Evaporated by 1 lb. of Coal,	$7\frac{1}{2}$ lbs.
Coal per hour to a square foot of Grate,	$10\frac{3}{10}$ "

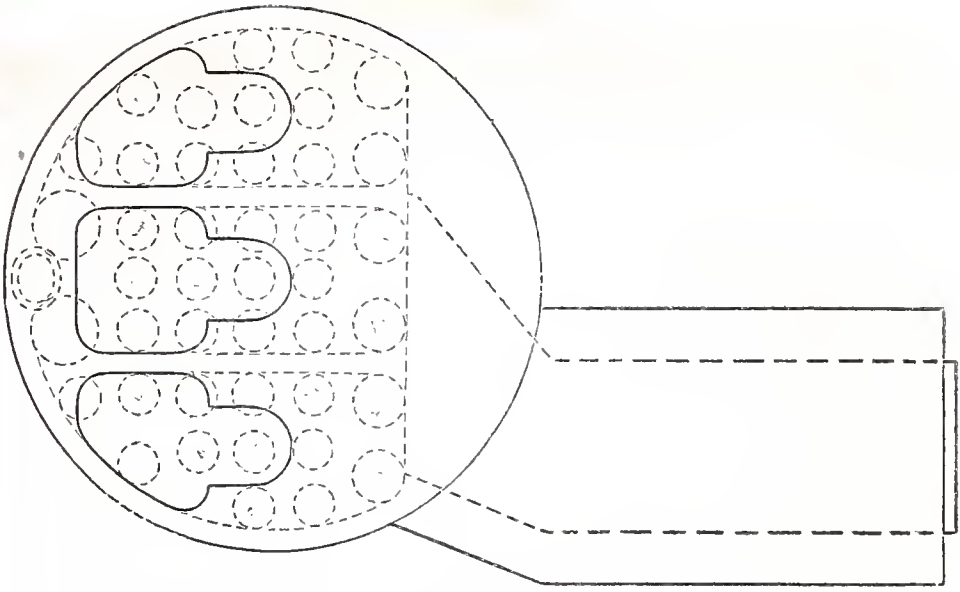
* Since deceased.

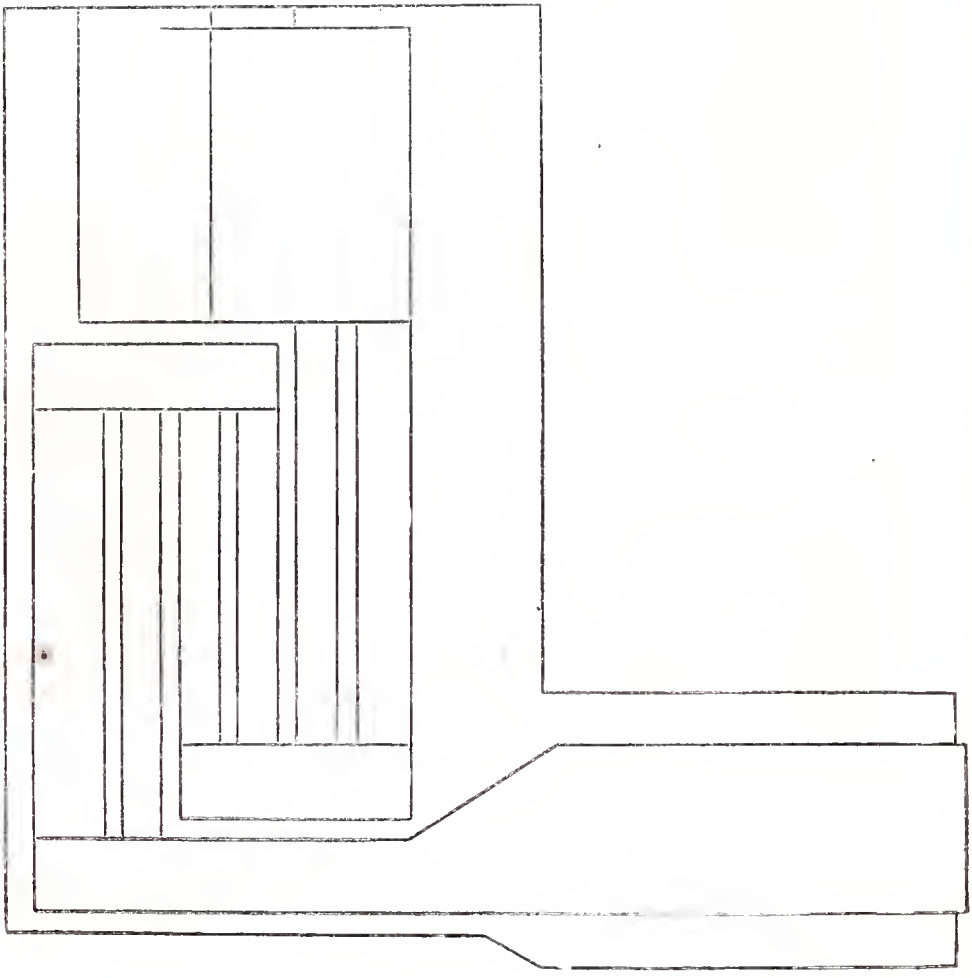
Boilers same as the Baltic's.

FRANKLIN.

Merchant Steamer running between New York and Havre. Engines and Boilers designed and constructed by Stillman, Allen & Co., New York.

		Feet.	Inches.
Length on Deck,		263	0
Breadth of Beam,		41	10
Depth of Hold,		26	0
Tonnage,	tons 2410		
Average Draft of Water,		18	0
Two Side Lever Engines.			
Diameter of Cylinders,		7	9
Length of Stroke,		8	0
Diameter of Paddle Wheels,		32	2
Length of Paddles,		11	8
Depth of "		2	0
Number of Paddles in each Wheel,	28		
Average Dip of Wheel,		6	9
Average Number of Revolutions,	13		
Average Pressure of Steam,	lbs. 15		
Cutting off at		3	0
Four Iron Boilers (back to back).			
Whole Amount of Fire Surface,	8528 square feet.		
" " Grate "	300 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$11\frac{3}{10}$ to 1.		
" " " Grate Surface,	$28\frac{4}{10}$ to 1.		
Area of 1st Flues,	57 square feet.		
" 2d "	46 "		
" 3d "	$43\frac{1}{2}$ "		
" Chimney,	50 "		
Height of " above Grate,	63 feet.		
Consumption of Bituminous Coal per hour,	6160 lbs.		
Water Evaporated by 1 lb. of Coal,	5 lbs.		
Coal per hour to a square foot of Grate,	$20\frac{1}{2}$ "		





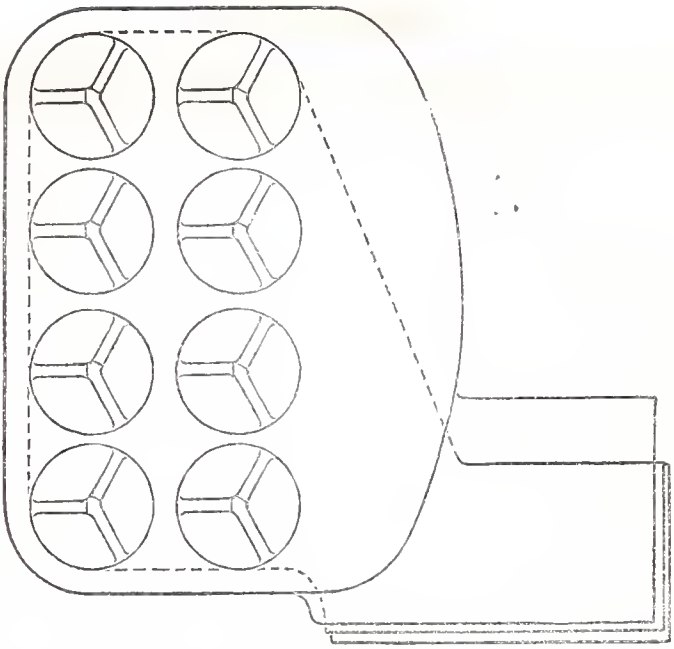
HUMBOLDT.*

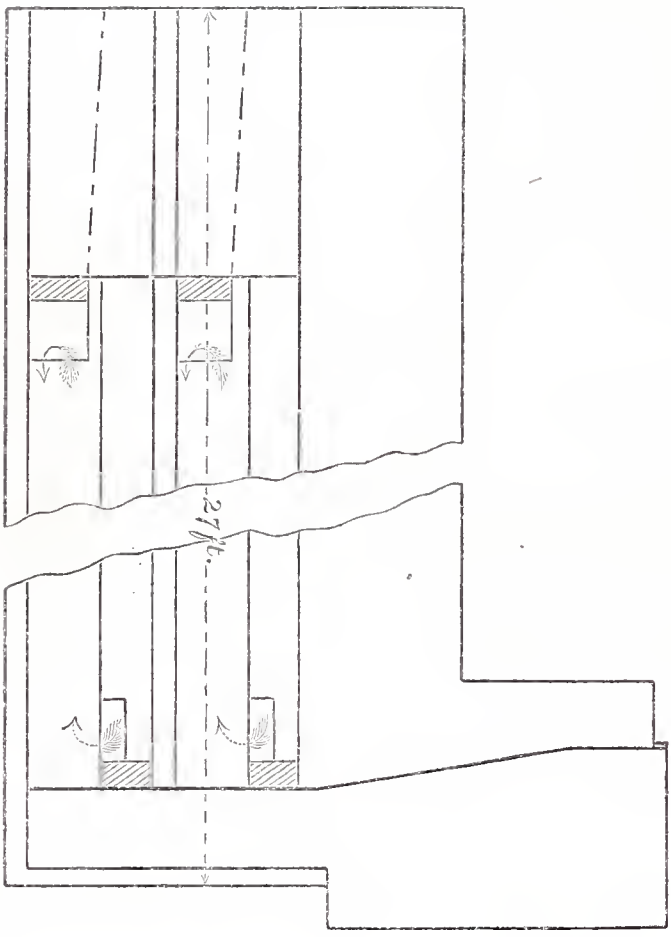
Merchant Steamer running between New York and Havre. Engines and Boilers designed and constructed by Stillman, Allen & Co., New York.

		Feet.	Inches.
Length on Deck,		284	0
Breadth of Beam,		46	0
Depth of Hold,		27	0
Tonnage,	tons 2856		
Average Draft of Water,	(estimated)	19	3
Two Side Lever Engines.			
Diameter of Cylinders,		7	11
Length of Stroke,		9	0
Diameter of Paddle Wheels,		34	2
Length of Paddles,		12	3
Depth of "		2	2
Number of Paddles in each Wheel,	36		
Average Dip of Wheel,	(estimated)	8	0
Average Number of Revolutions,	" 14		
Average Pressure of Steam,	" lbs. 15		
Cutting off at		4	0
Four Iron Boilers (back to back).			
Whole Amount of Fire Surface,	11,332 square feet.		
" " " Grate "	608 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{8}{10}$ to 1.		
" " " " Grate Surface,	$18\frac{6}{10}$ to 1.		
Area of 1st, 2d, and 3d Flues, each	56 square feet.		
" Chimney,	$56\frac{1}{2}$ "		
Height of " above Grate,	65 feet.		
Consumption of Bituminous Coal per hour, est'd	6440 lbs.		
Water Evaporated by 1 lb. of Coal,	7 "		
Coal per hour to a square foot of Grate,	$10\frac{1}{2}$ "		

Note.—The consumption of Fuel is estimated from the trial trip.

* Now on her first passage.



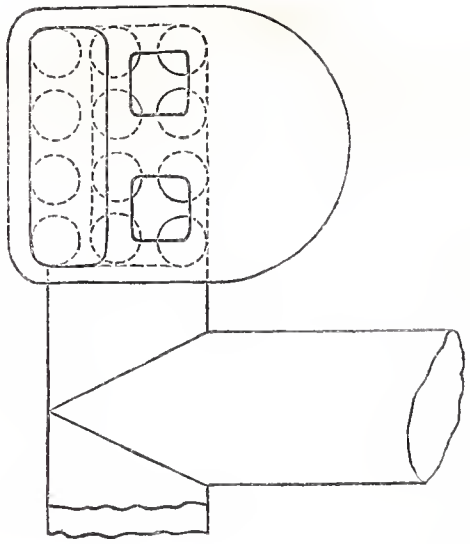

27½ft.

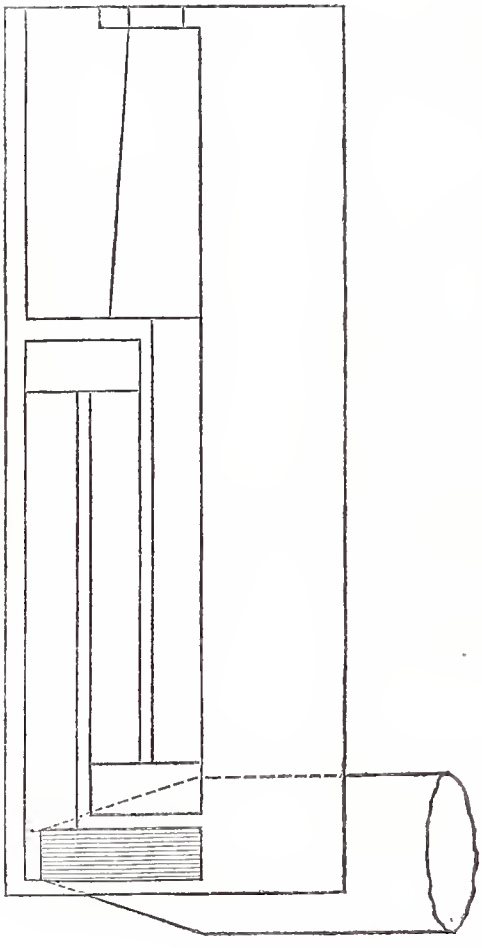
OSPREY.

Merchant Steamer running between Philadelphia and Charleston. Engine and Boilers designed and constructed at the West Point Foundry.

		Feet.	Inches.
Length on Deck,		145	0
Breadth of Beam,		27	0
Depth of Hold,		11	0
Tonnage,	tons 388		
Average Draft of Water,		10	
One Steeple Engine.			
Diameter of Cylinder,		4	6
Length of Stroke,		6	0
Diameter of Paddle Wheels,		23	0
Length of Paddles,		6	0
Depth of "	14 inches each, or	2	4
Number of Double Paddles in each Wheel,	20		
Average Dip of Wheel,		3	6
Average Number of Revolutions,	16		
Average Pressure of Steam,	lbs. 18		
Cutting off at		3	9
Two Iron Boilers (one each side of engine).			
Whole Amount of Fire Surface,	1420 square feet.		
" " Grate Surface,	80 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$14\frac{8}{100}$ to 1.		
" " " Grate Surface,	$17\frac{6}{100}$ to 1.		
Area of 1st, 2d, and 3d Flues, each	$9\frac{8}{100}$ square feet.		
" Chimney,	$10\frac{1}{2}$ "		
Height of " above Grate,	40 feet.		
Consumption of Anthracite Coal per hour,*	1680 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{15}{100}$ lbs.		
Coal per hour to a square foot of Grate,	21 "		

* Fan blast under grate.





8

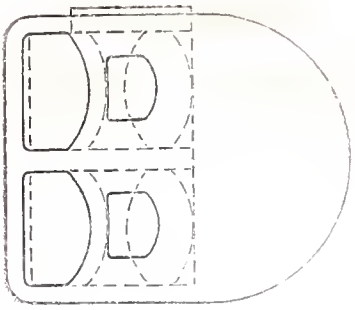
OSPREY.*

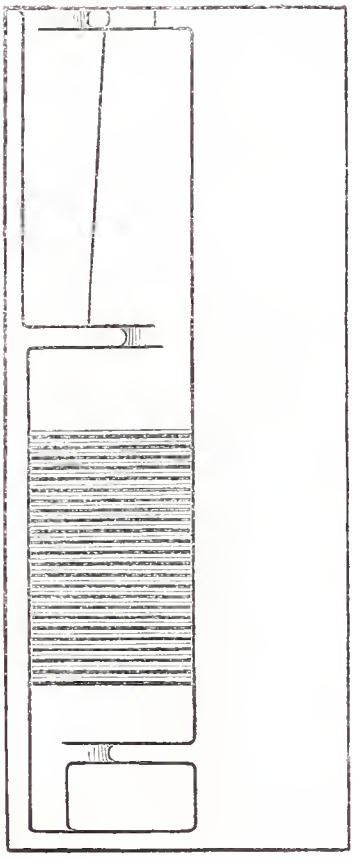
Merchant Steamer running between Philadelphia and Charleston. Engine designed and constructed at the West Point Foundry; boilers by Merrick & Son, Philadelphia.

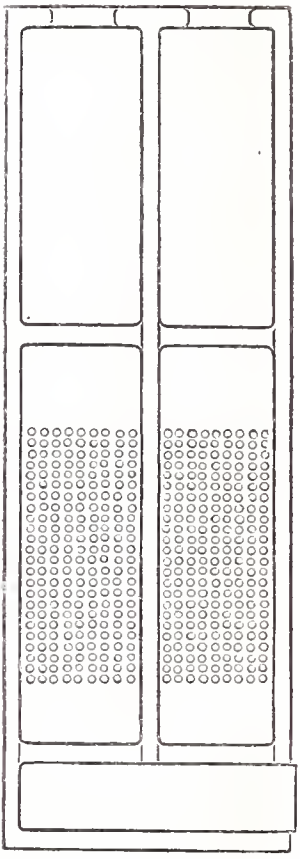
		Feet.	Inches.
Length on Deck,		175	0
Breadth of Beam,		27	0
Depth of Hold,		18	0
Tonnage,	tons 610		
Average Draft of Water,		9	6
One Steeple Engine.			
Diameter of Cylinder,		4	6
Length of Stroke,		6	0
Diameter of Paddle Wheels,		24	6
Length of Paddles,		6	0
Depth of "	14 inches each, or	2	4
Number of Paddles in each Wheel,	20		
Average Dip of Wheel,		3	6
Average Number of Revolutions,	15		
Average Pressure of Steam,	lbs. 20		
Cutting off at		3	9
Two Iron Boilers (one each side of engine); tubes 2 in. outside dia'r.			
Whole Amount of Fire Surface,	2632 square feet.		
" " Tube Surface,	1766 "		
" " Grate Surface,	77 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$27\frac{1}{2}$ to 1.		
" " " Grate Surface,	34 to 1.		
Area of space between Tubes,	18 square feet.		
" Chimney,	$10\frac{1}{2}$ "		
Height of " above Grate,	40 feet.		
Consumption of Anthracite Coal per hour,†	1284 lbs.		
Water Evaporated by 1 lb. of Coal,	7 lbs.		
Coal per hour to a square foot of Grate,	$16\frac{6}{10}$ "		

* With increased hull, new boilers, and Pirsson's fresh water condenser. About $\frac{1}{8}$th of the usual quantity of water is blown out, to prevent the accumulation of oil in the boiler.

† With fan blast under grate.





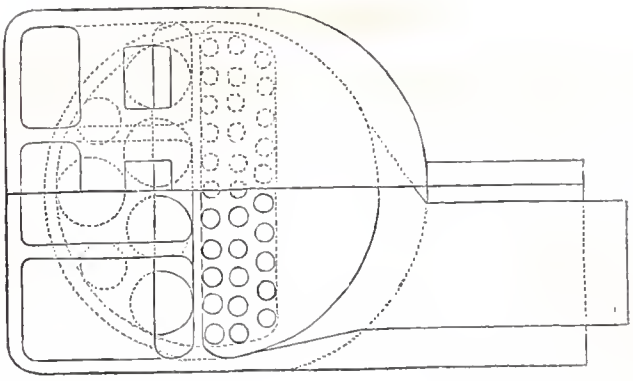


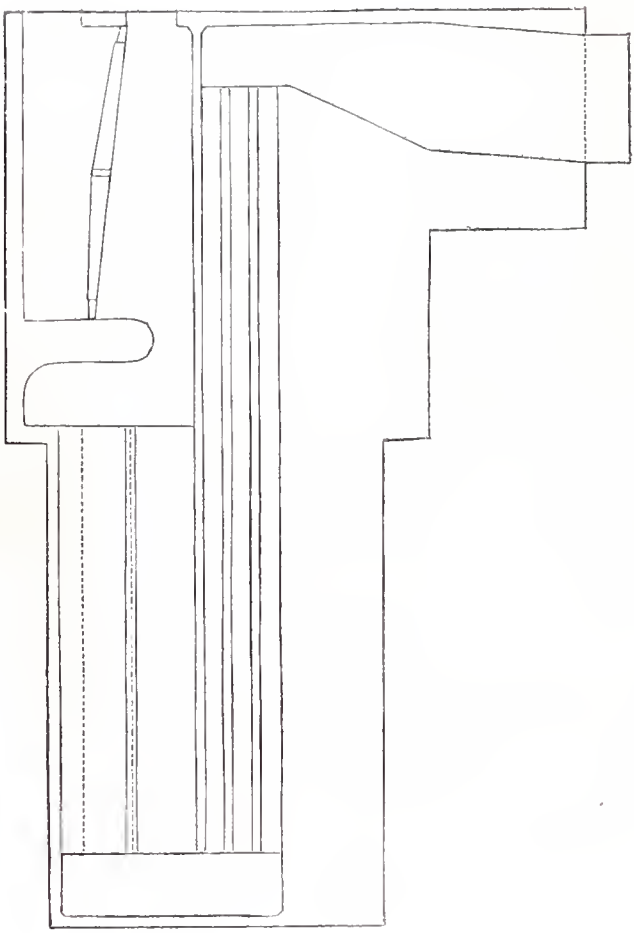
ALBATROSS.*

Merchant Steamer running between Philadelphia and Charleston. Engines and boilers designed and constructed by James T. Sutton & Co Philadelphia.

	Feet.	Inches.
Length on Deck,	171	0
Breadth of Beam,	27	4
Depth of Hold,	19	0
Tonnage,	tons 610	
Average Draft of Water,	10	6
Two Oscillating Engines.		
Diameter of Cylinders,	3	4
Length of Stroke,	3	4
Diameter of Propeller,	10	0
Length of do.	4	6
Angle at Hub,	—	
" Periphery,	50°	
Pitch at "	26	6
Number of Blades,	4	
Area of "	84 square feet.	
Average Number of Revolutions of Engines,	32	
" " " " Propeller,	56	
" Pressure of Steam,	lbs. 23	
Cutting off at	1 ft.	8 in.
Two Iron Boilers (side by side,)		
Whole Amount of Fire Surface,	3334 square feet.	
" " " Grate "	102 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$57\frac{1}{4}$ to 1.	
" " " Grate Surface,	$32\frac{3}{4}$ to 1.	
Area of 1st Flues,	$11\frac{3}{4}$ square feet.	
" 2d "	$12\frac{6}{10}$ "	
" Chimney,	14 "	
Height of " above Grate,	45 feet.	
Consumption of Anthracite Coal per hour,	1680 lbs.	
Water Evaporated by 1 lb. of Coal,	$5\frac{8}{10}$ "	
Coal per hour to a square foot of Grate,	$16\frac{1}{2}$ "	

* With Pirsson's Fresh Water Condenser.



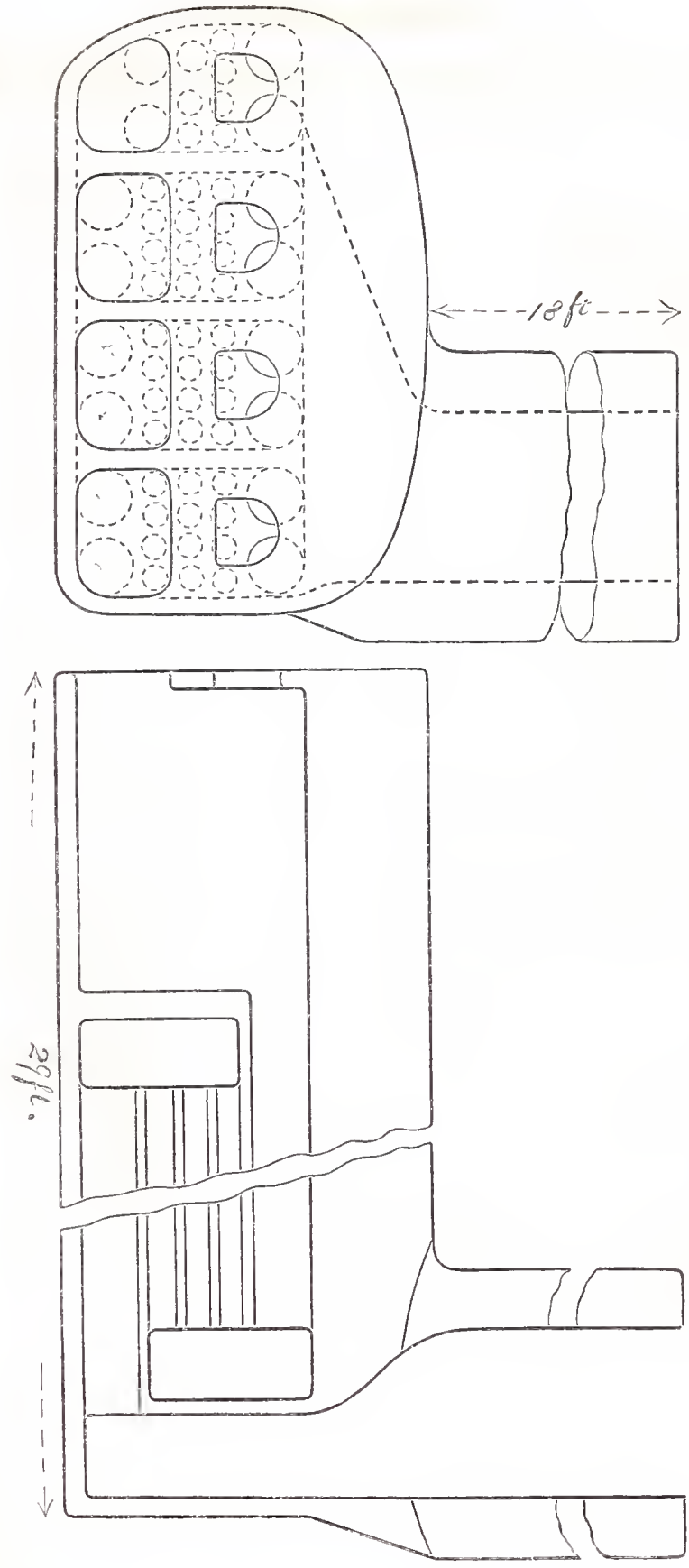


PIONEER.*

Merchant Steamer to run between New York and Liverpool. Engines and Boilers, designed and constructed at the West Point Foundry.

	Feet.	Inches.
Length on Deck,	230	0
Breadth of Beam,	42	0
Depth of Hold,	31	0
Tonnage, tons	1903	
Average Draft of Water, (estimated)	19	0
Two Vertical Direct Action Trunk Engines (Cylinders over Cranks).		
Diameter of Cylinders,	7	$\frac{1}{2}$
" Trunks,	3	3
Length of Stroke,	4	3
Diameter of Propeller,	16	0
Length of "	5	0
Angle at Hub,	17°	
" Periphery,	56°	
Pitch at Hub,	27	6
" at Periphery,	34	0
Number of Blades,	3	
Area "	108 square feet.	
Average Number of Revolutions, (estimated)	35	
Average Pressure of Steam, " lbs.	15	
Cutting off at	2	$1\frac{1}{2}$
Two Iron Boilers (side by side).		
Whole Amount of Fire Surface,	7279 square feet.	
" " Grate "	217 "	
Ratio of Fire Surface to cubic foot of Cylinder,	28 to 1.	
" " " Grate Surface,	$33\frac{1}{2}$ to 1.	
Area of 1st Flues,	29 square feet.	
" 2d "	$30\frac{4}{10}$ "	
" 3d "	$27\frac{1}{4}$ "	
" Chimney,	32 "	
Height of " above Grate,	59 feet.	6
Consumption of Bituminous Coal per hour,	———	
Coal per hour to a square foot of Grate,	—	

* Not yet finished.

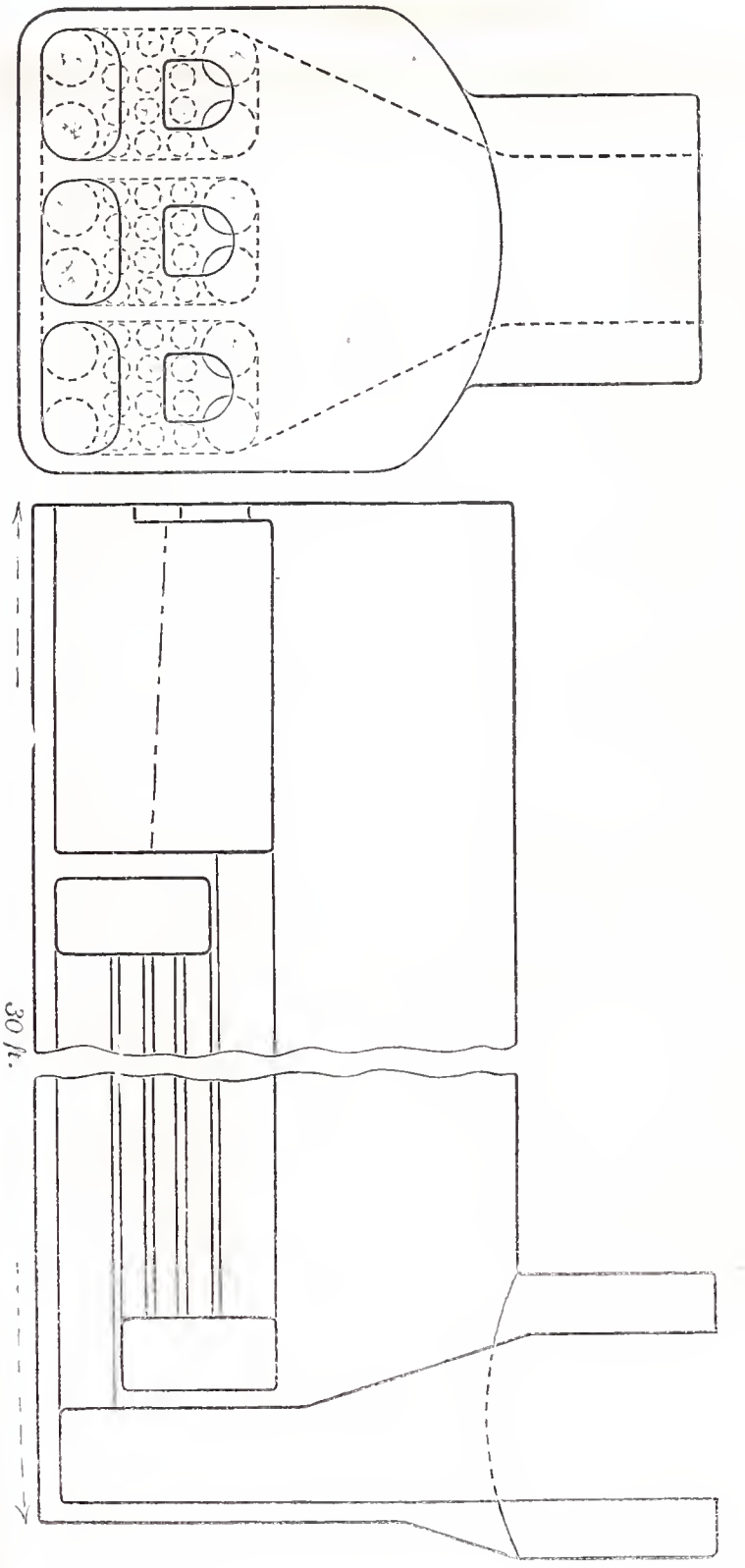

18ft
28ft.

CITY OF PITTSBURGH.*

Merchant Steamer to run between Philadelphia and Liverpool. Engines and boilers designed and constructed at the West Point Foundry.

	Feet.	Inches.
Length on Deck,	245	0
Breadth of Beam,	38	0
Depth of Hold,	33	0
Tonnage,	tons 1672	
Average Draft of Water, (estimated)	18	0
Two Vertical Direct Action Trunk Engines (Cylinders over Cranks).		
Diameter of Cylinders,	7	$\frac{1}{2}$
" Trunks,	3	3
Length of Stroke,	4	3
Diameter of Propeller,	16	0
Length of "	5	0
Angle at Hub,	16°	
" Periphery,	54°	
Pitch at Hub,	29 ft.	6 in.
" Periphery,	36	0
Number of Blades,	3	
Area "	108 square feet.	
Average Number of Revolutions, (estimated)	35	
" Pressure of Steam, "	lbs. 15	
Cutting off at	2	$1\frac{1}{2}$
Three Iron Boilers (side by side,)		
Whole Amount of Fire Surface,	8028 square feet.	
" " Grate "	226 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$30\frac{9}{10}$ to 1.	
" " " Grate Surface,	$35\frac{1}{2}$ to 1.	
Area of 1st Flues,	$28\frac{4}{10}$ square feet.	
" 2d "	$37\frac{6}{10}$ "	
" 3d "	$28\frac{4}{10}$ "	
" Chimney,	$37\frac{6}{10}$ "	
Height of " above Grate,	59 ft. 6 in.	
Consumption of Coal per hour,	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* Not yet Finished.

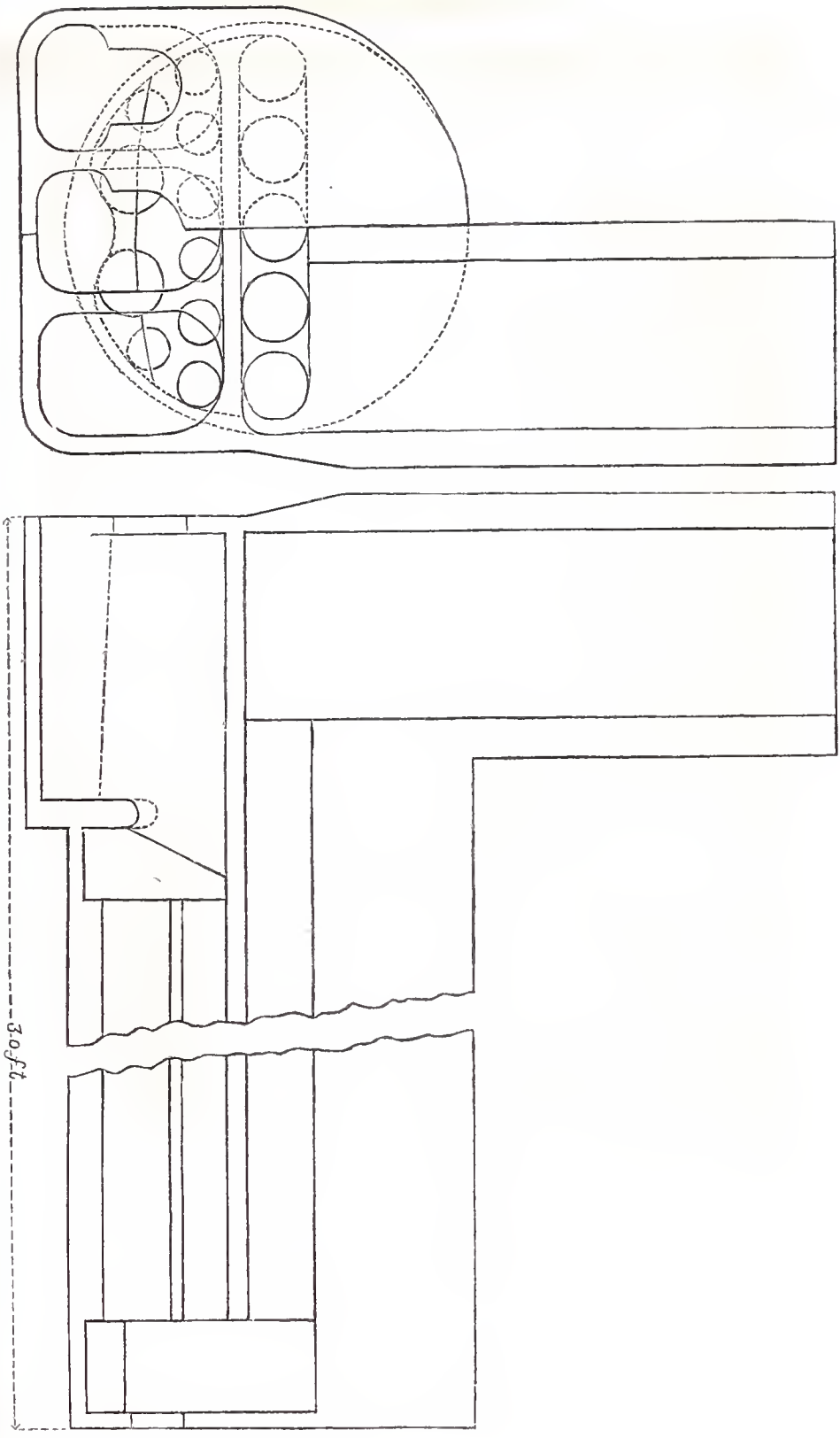


9

EL DORADO.

Merchant Steamer running from New Orleans to Chagres. Engines and Boilers designed and constructed by Cunningham, Belknap & Co., New York.

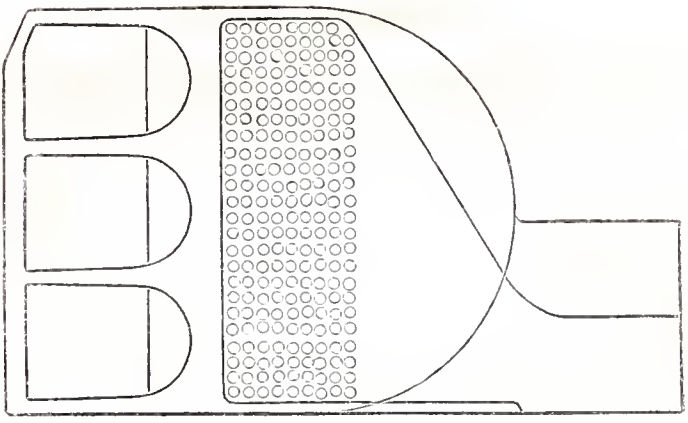
		Feet.	Inches.
Length on Deck,		235	0
Breadth of Beam,		31	0
Depth of Hold,		23	0
Tonnage,	tons 1092		
Average Draft of Water,		12	0
Two Beam Engines.			
Diameter of Cylinders,		4	2
Length of Stroke,		10	
Diameter of Paddle Wheels,		29	4
Length of Paddles,		8	10
Depth of "		2	0
Number of Paddles in each Wheel,	30		
Average Dip of Wheel,		5	0
Average Number of Revolutions,	16		
Average Pressure of Steam,	" lbs. 10		
Cutting off at		5	0
Two Iron Boilers (side by side)			
Whole Amount of Fire Surface,	3838 square feet.		
" " Grate "	143 "		
Ratio of Fire Surface to cubic foot of Cylinder,	14 to 1.		
" " " " Grate Surface,	$26\frac{8}{10}$ to 1.		
Area of 1st Flues,	28 square feet.		
" 2d "	$26\frac{4}{10}$ "		
" Chimney,	32 "		
Height of " above Grate,	59 feet.		
Consumption of Bituminous Coal per hour,	2500 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{1}{4}$ lbs.		
Coal per hour to a square foot of Grate,	17 "		

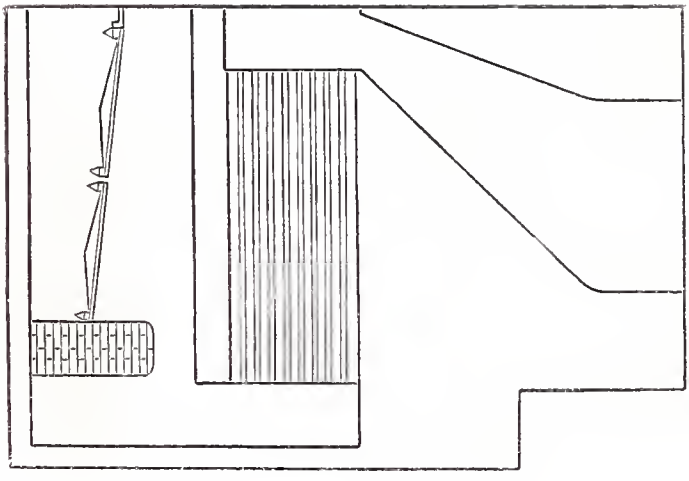

30 ft

MONUMENTAL CITY.

Merchant Steamer running from Panama to San Francisco. Engines and boilers designed and constructed by Murry & Hazlehurst, Baltimore.

	Feet.	Inches.
Length on Deck,	180	0
Breadth of Beam,	30	0
Depth of Hold,	15	0
Tonnage,	tons 768	
Average Draft of Water,	12	0
Two Oscillating Engines (direct action).		
Diameter of Cylinders,	3	8
Length of Stroke,	3	0
Diameter of Propeller,	12	0
Length of "	3	0
Angle at Hub,	10°	
" at Periphery,	55½°	
Pitch at "	25	0
Number of Blades,	4	
Area of "	54 4/10 square feet.	
Average Number of Revolutions,	40	
Average Pressure of Steam,	lbs. 15	
Cutting off at	2	0
Two Iron Boilers (side by side).		
Whole Amount of Fire Surface,	3230 square feet.	
" " Tube "	2520 "	
" " Grate "	102 "	
Ratio of Fire Surface to cubic foot of Cylinder,	51 to 1.	
" " " Grate Surface	31½ to 1.	
Area of Tubes,	21 square feet.	
" Chimney,	16 "	
Height of " above Grate,	49 ft. 7 in.	
Consumption of Bituminous Coal per hour,	1680 lbs.	
Water Evaporated by 1 lb. of Coal,	8 "	
Coal per hour to a square foot of Grate,	16 5/10 "	

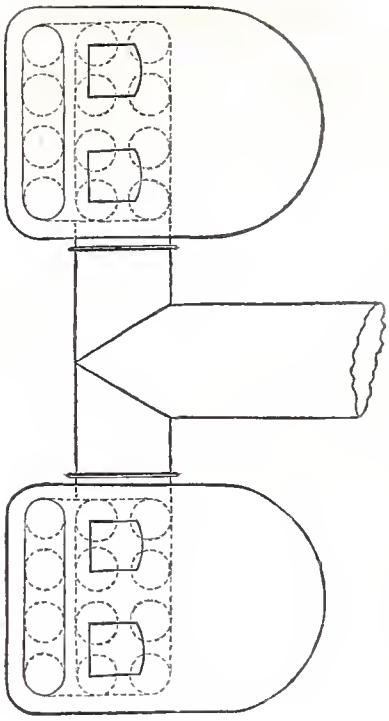


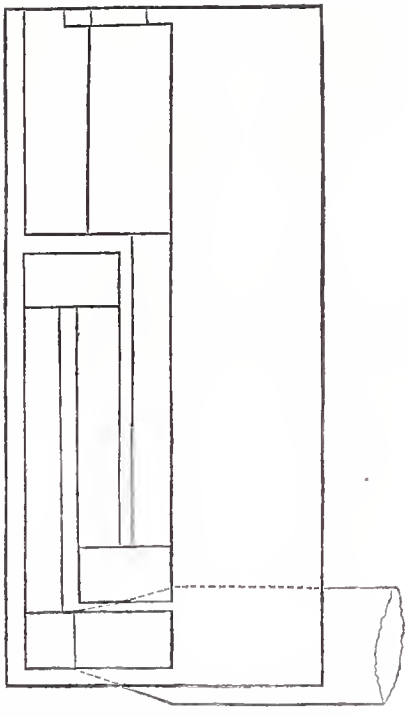


VIXEN.

War Steamer belonging to the United States Navy. Engine and boilers designed and built by the West Point Foundry.

	Feet.	Inches.
Length on Deck,	118	0
Breadth of Beam,	22	6
Depth of Hold,	9	3
Tonnage, tons	234	
Average Draft of Water,	7	0
One Horizontal Half Beam Engine (Lighthall's patent).		
Diameter of Cylinder,	3	0
Length of Stroke,	6	0
Diameter of Paddle Wheels,	18	6
Length of Paddles,	6	3
Depth of "	1	9
Number of Paddles in each Wheel,	14	
Average Dip of Wheel,	3	0
Average Number of Revolutions,	15	
Average Pressure of Steam, lbs.	15	
Cutting off at	3	0
Two Iron Boilers (one each side of engine).		
Whole Amount of Fire Surface,	756 square feet.	
" " Grate "	47 "	
Ratio of Fire Surface to cubic foot of Cylinder,	18 to 1.	
" " " Grate Surface,	16 to 1.	
Area of 1st, 2d, and 3d Flues, each	$6\frac{3}{10}$ square feet.	
" Chimney,	$6\frac{3}{10}$ "	
Height of " above Grate,	43 ft. 9 in.	
Consumption of Bituminous Coal per hour,	600 lbs.	
Water Evaporated by 1 lb. of Coal,	$4\frac{1}{2}$ lbs.	
Coal per hour to a square foot of Grate,	$12\frac{3}{4}$ "	





GOLDEN GATE.*

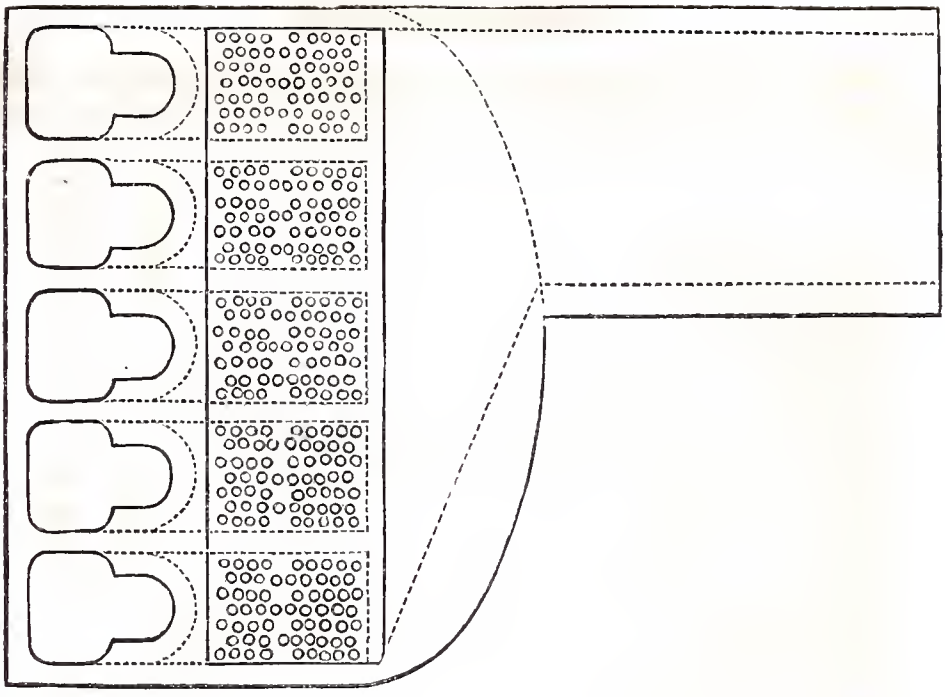
Merchant Steamer to run from San Francisco to Panama. Engines designed and constructed by Stillman Allen & Co., New York.

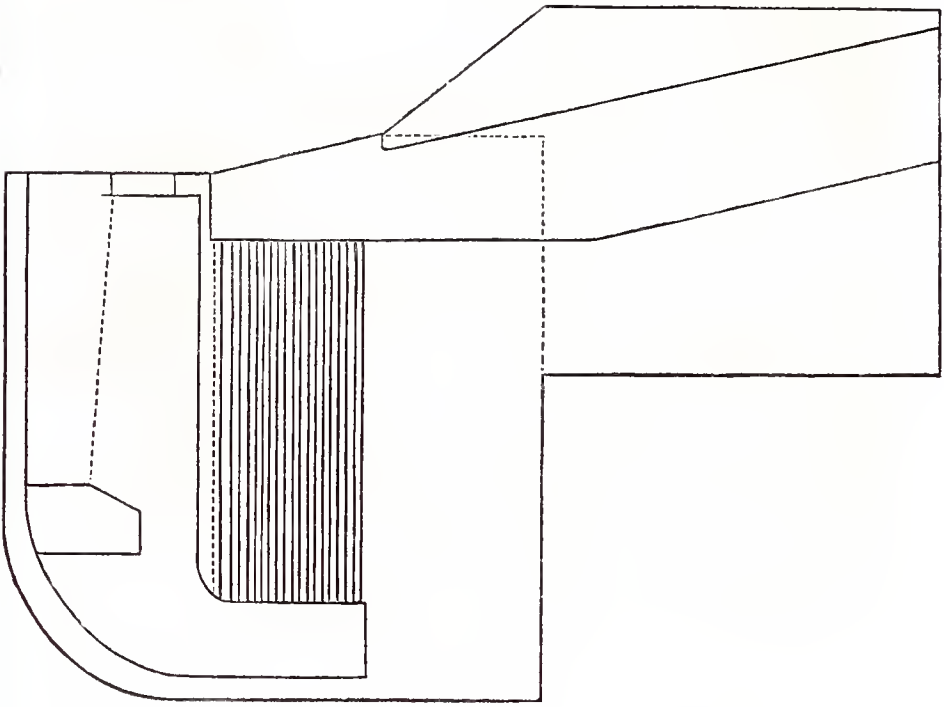
		Feet.	Inches.
Length on Deck,		265	0
Breadth of Beam,		40	0
Depth of Hold,		22	0
Tonnage,	tons 2030		
Average Draft of Water, (estimated)		17	6
Two Oscillating Engines.			
Diameter of Cylinders,		7	1
Length of Stroke,		9	0
Diameter of Paddle Wheels,		32	0
Length of Paddles,		11	0
Depth of "		2	4
Number of Paddles in each Wheel,	30		
Average Dip of Wheel, (estimated)		6	0
Average Number of Revolutions,	—		
Average Pressure of Steam,	—		
Cutting off at	—		

Four Iron Boilers, two aft and two forward of engines, two chimnies.

Whole Amount of Fire Surface,	12,052 square feet.
" " Tube Surface, tubes 3 ins. bore	8396 "
" " Grate Surface,	367 "
Ratio of Fire Surface to cubic foot of Cylinder,	17 to 1.
" " " Grate Surface,	$32\frac{8}{10}$ to 1.
Area of tubes	$61\frac{3}{4}$ square feet.
" Chimnies,	57 "
Height of " above Grate,	60 feet.
Consumption of Bituminous Coal per hour,	
Water Evaporated by 1 lb. of Coal,	
Coal per hour to a square foot of Grate,	

* Finished but not yet made a trial trip.



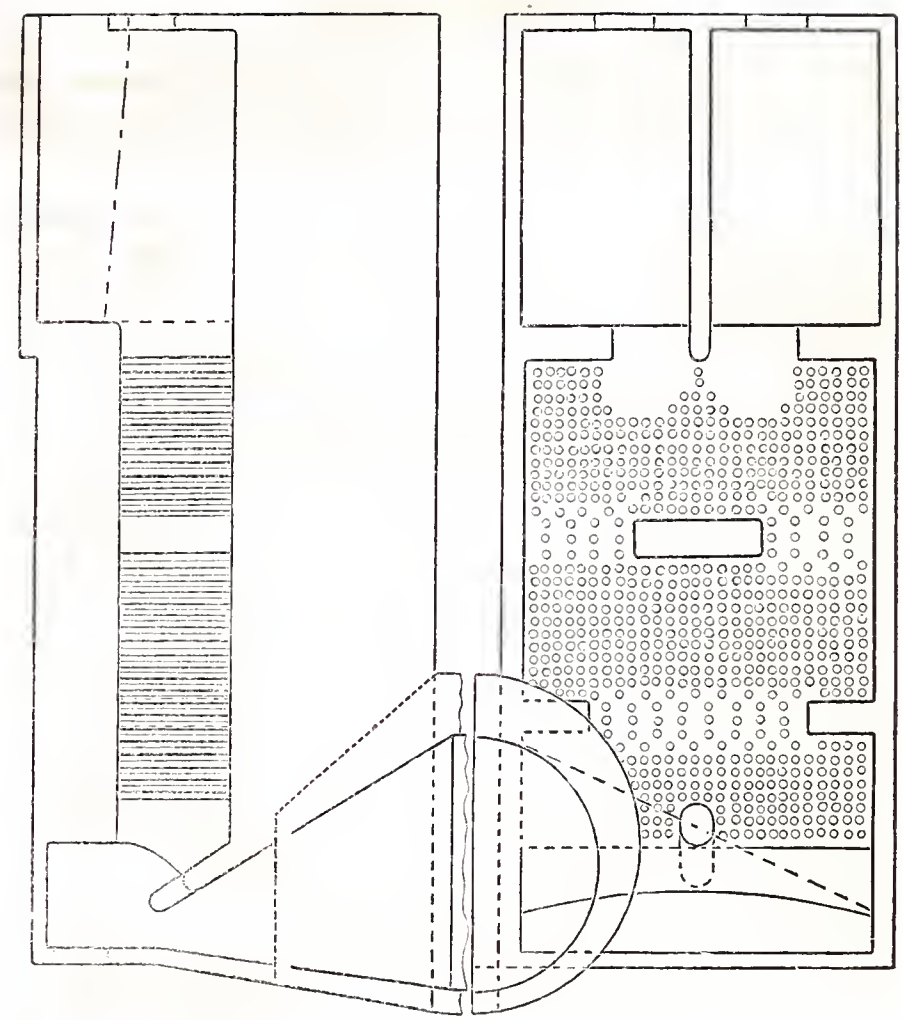


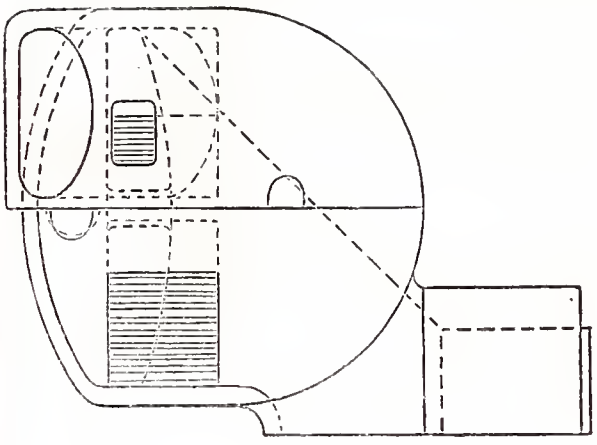
CONSTITUTION.

Merchant Steamer running between Panama and San Francisco. Engines designed and constructed by I. P. Morris & Co., of Philadelphia; boilers by R. F. Loper, Esq., and constructed by I. P. Morris & Co.

	Feet.	Inches.
Length on Deck,	165	0
Breadth of Beam,	25	4
Depth of Hold,	17	0
Tonnage,	tons 467	
Average Draft of Water,	11	0
Two Direct Action Engines, Cylinders above Cranks.		
Diameter of Cylinders,	2	10
Length of Stroke,	2	10
Diameter of Propeller,	10	4
Length of "	4	7
Angle at Hub,	30°	
" at Periphery,	45°	
Pitch at "	32	5¼
Number of Blades,	3	
Area of "	68¼ square feet.	
Average Number of Revolutions,	40	
Average Pressure of Steam,	lbs. 32	
Cutting off at	1	9
Two Iron Boilers; tubes 2 in. outside diameter.		
Whole Amount of Fire Surface,	3316 square feet.	
" " Tube Surface,	2188 "	
" " Grate Surface,	96 "	
Ratio of Fire Surface to cubic foot of Cylinder,	93 to 1.	
" " " Grate Surface,	34½ to 1.	
Area of space between Tubes,	20 square feet.	
" Chimney,	19$\frac{6}{10}$ "	
Height of " above Grate,	46 feet.	
Consumption of Anthracite Coal per hour,*	—— lbs.	
Water Evaporated by 1 lb. of Coal,	— lbs.	
Coal per hour to a square foot of Grate,	— "	

* No authentic account of fuel consumed.



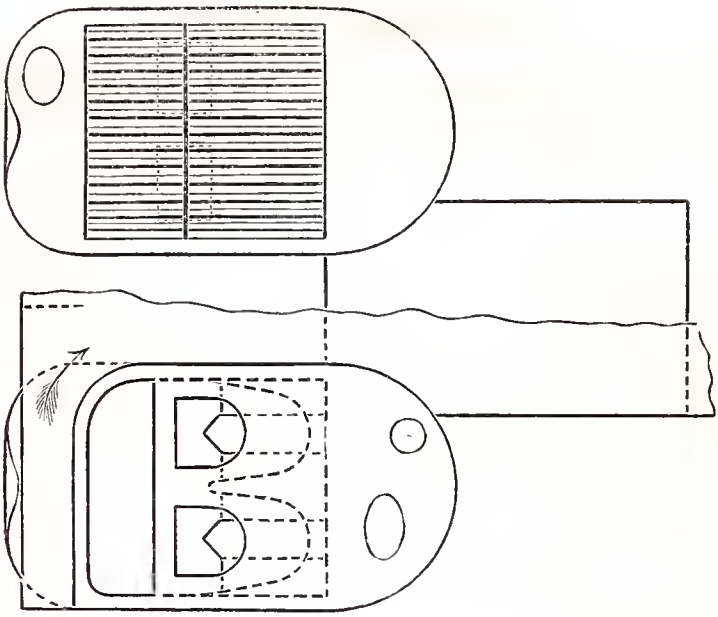


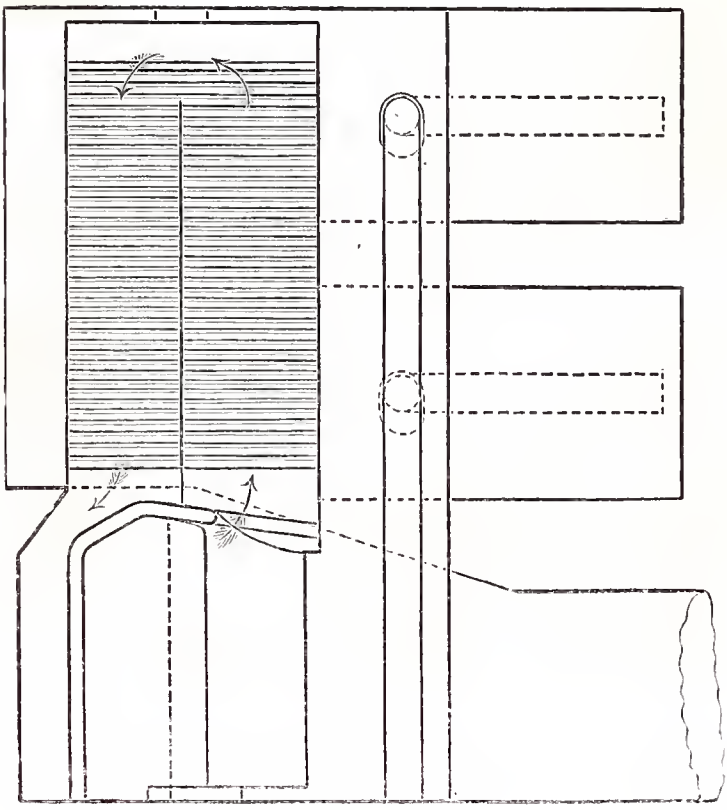
UNION.

Merchant Steamer running between Panama and San Francisco. Engines and Boilers, designed and constructed Reaney, Neafie & Co., Philadelphia.

	Feet.	Inches.
Length on Deck,	180	0
Breadth of Beam,	25	4
Depth of Hold,	17	0
Tonnage,	tons 513	
Average Draft of Water,	11	0
Two Direct Action Engines, Cylinders over Cranks.		
Diameter of Cylinders,	2	10
Length of Stroke,	2	10
Diameter of Propeller,	10	0
Length of "	4	4
Angle at Hub,	30°	
" Periphery,	49°	
Pitch at Centre of Pressure,	31	4
Number of Blades,	4	
Area "	78 square feet.	
Average Number of Revolutions,	40	
Average Pressure of Steam,	lbs. 30	
Cutting off at	1	5
Two Iron Boilers; tubes 2 in. diameter outside.		
Whole Amount of Fire Surface,	4150 square feet.	
" " Tube "	3264 "	
" " Grate "	$62\frac{1}{2}$ "	
Ratio of Fire Surface to cubic foot of Cylinder,	118 to 1.	
" " " Grate Surface,	$66\frac{4}{10}$ to 1.	
Area of Space between Tubes,	17 square feet.	
" Chimney,	$19\frac{6}{10}$ "	
Height of " above Grate,	40 feet.	
Consumption of Anthracite Coal per hour,*	1200 lbs.	
Water Evaporated by 1 lb. of Coal,	$7\frac{35}{100}$ "	
Coal per hour to a square foot of Grate,	$19\frac{2}{10}$ "	

* On trial trip to New York.



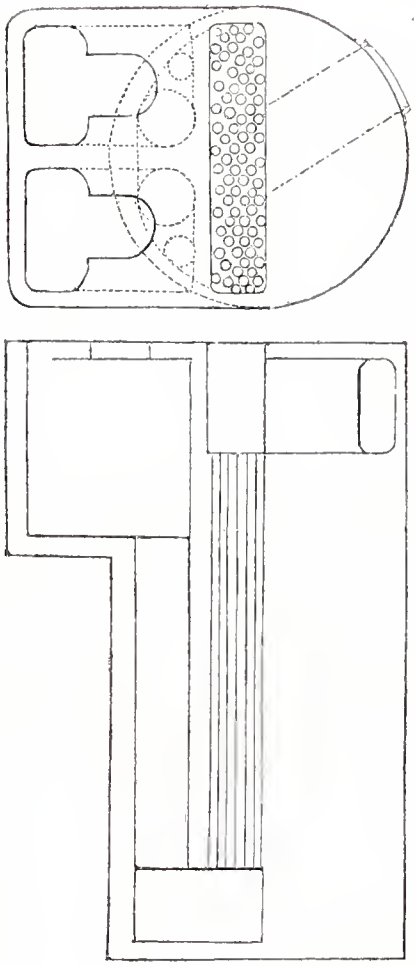


MASSACHUSETTS.

War Steamer, belonging to the United States Navy. Engines and Boilers designed by John Ericsson, Esq., and constructed by Hogg & Delamater, New York.

	Feet.	Inches.
Length on Deck,	161	0
Breadth of Beam,	31	9
Depth of Hold,	20	0
Tonnage,	tons 779	
Average Draft of Water,	15	3
Two Inclined Engines.		
Diameter of Cylinders,	2	1
Length of Stroke,	3	0
Diameter of Propeller,	9	6
Length of "	3	$1\frac{3}{4}$
Angle at Hub,	—	
" Periphery,	56°	
Pitch at Periphery,	20	0
Number of Blades,	6	
Area "	75 square feet.	
Average Number of Revolutions,	50	
" Pressure of Steam,	lbs. 40	
Cutting off at	1	6
Two Iron Boilers (side by side,)		
Whole Amount of Fire Surface,	1580 square feet.	
" " Grate "	47 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$77\frac{4}{10}$ to 1.	
" " " Grate Surface,	$33\frac{6}{10}$ to 1.	
Area of 1st Flues,	$6\frac{8}{10}$ square feet.	
" Tubes,	$5\frac{4}{10}$ "	
" Chimney,	$6\frac{3}{10}$ "	
Height of " above Grate,	—	
Consumption of Anthracite Coal per hour,	940 lbs.	
Water Evaporated by 1 lb. of Coal,	$7\frac{8}{10}$ "	
Coal per hour to a square foot of Grate,	20 "	

* Draft produced by an Exhausting Fan in chimney.

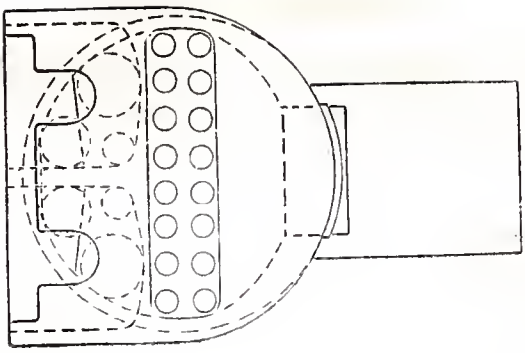


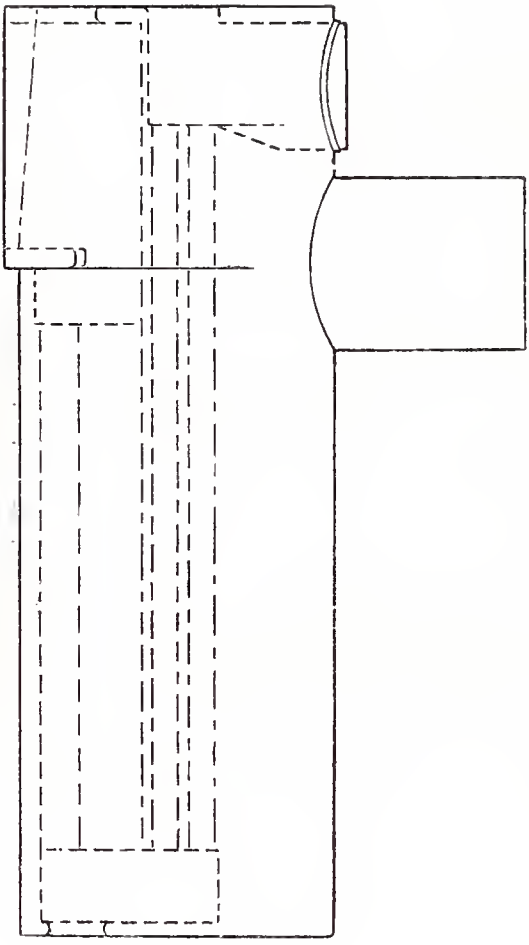
RESCUE.*

Steam Tug for New York Harbor. Engines and Boiler designed and constructed by Reaney, Neafie & Co., Philadelphia.

	Feet.	Inches.
Length on Deck,	106	6
Breadth of Beam,	20	0
Depth of Hold,	9	0
Tonnage,	tons 173	
Average Draft of Water (estimated),	9	9
Two Vertical Direct Action Engines; Cylinders over Cranks.		
Diameter of Cylinders,	2	2
Length of Stroke,	2	2
Diameter of Propeller,	8	2
Length of "	4	0
Angle at Hub,	30°	
" Periphery,	48°	
Pitch at Centre of Pressure,	18	6
Number of Blades,	4	
Area of "	56 square feet.	
Average Number of Revolutions (estimated),	56	
" Pressure of Steam, "	lbs. 35	
Cutting off at	$11\frac{1}{2}$ inches.	
One Iron Boiler.		
Whole Amount of Fire Surface,	1013 square feet.	
" " " Grate "	36 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$63\frac{3}{10}$ to 1.	
" " " Grate Surface,	28 to 1.	
Area of 1st Flues,	$6\frac{1}{2}$ square feet.	
" 2d "	$4\frac{1}{4}$ "	
" Chimney,	7 "	
Height of " above Grate,	32 feet.	
Consumption of Anthracite Coal per hour,	——	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* Not yet Finished.





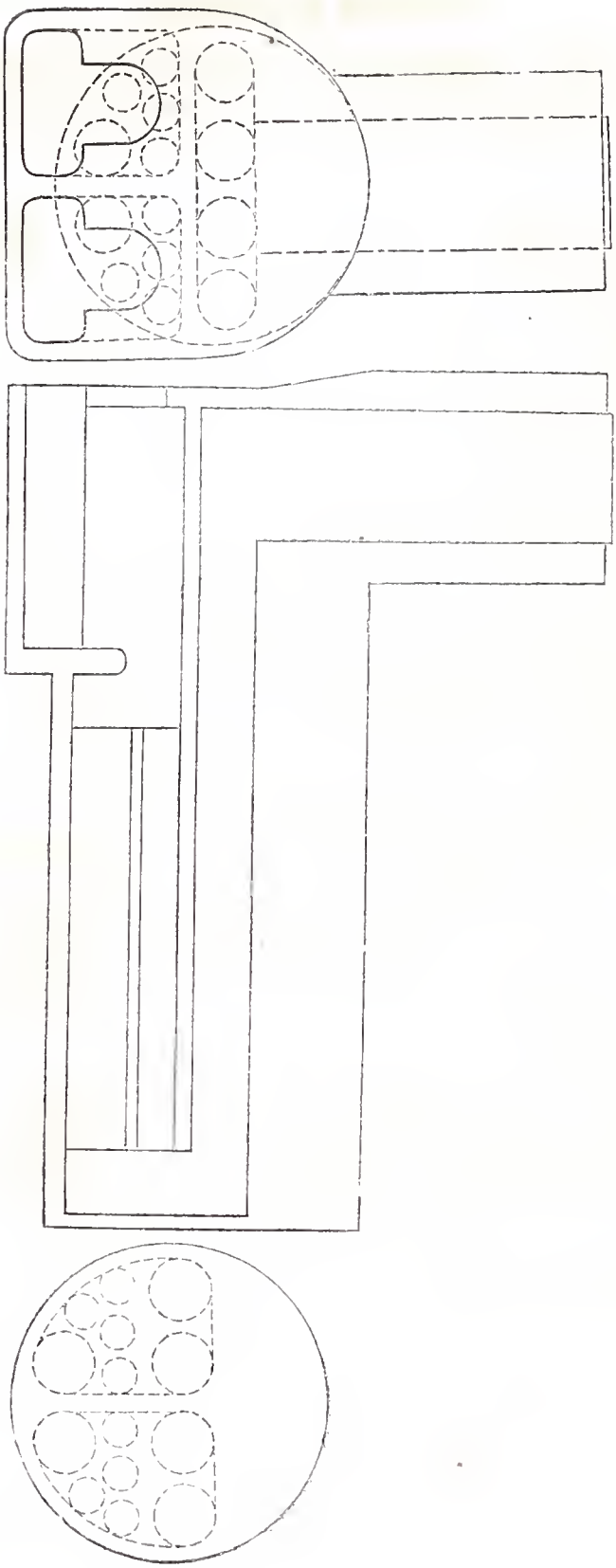
NORTH AMERICA.

River Steamer running on the Hudson river from New York to Albany. Engine and Boilers designed and constructed by James Cunningham, Esq., Phœnix Foundry, New York.

	Feet.	Inches.
Length on Deck,	230	0
Breadth of Beam,	26	0
Depth of Hold,	9	0
Tonnage,	tons 527	
Draft of Water,	5	0
One Beam Engine,		
Diameter of Cylinder,	4	0
Length of Stroke,	11	0
Diameter of Paddle Wheels,	28	0
Length of Paddles,	10	0
Depth of "	2	4
Number of Paddles in each Wheel, 28, divided in two rows of 14 each.		
Average Dip of Wheel,	2	4
Average Number of Revolutions,	23	
Average Pressure of Steam,	lbs. 35	
Cutting off at	5	6
Two Iron Boilers (one on each guard).*		
Whole Amount of Fire Surface,	1876 square feet.	
" " Grate "	84 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$13\frac{6}{10}$ to 1.	
" " " Grate Surface	$22\frac{3}{10}$ to 1.	
Area of 1st Flues,	17 square feet.	
" 2d "	14 "	
" Chimnies,	17 "	
Height of " above Grate,	50 feet.	
Consumption of Anthracite Coal per hour,†	4000 lbs.	
Water Evaporated by 1 lb. of Coal,	$5\frac{4}{10}$ lbs	
Coal per hour to a square foot of Grate,	$47\frac{6}{10}$ "	

* These boilers were the first of this form built, and may be considered the first that used anthracite coal with success.

† Fan blast under grate.



SOUTH AMERICA.

River Steamer running from New York to Albany. Engine and Boilers designed and constructed by James Cunningham, Esq., Phœnix Foundry, New York.

		Feet.	Inches.
Length on Deck,		260	0
Breadth of Beam,		26	9
Depth of Hold,		9	3
Tonnage,	tons 633		
Average Draft of Water,		5	0
One Beam Engine.			
Diameter of Cylinder,		4	6
Length of Stroke,		11	
Diameter of Paddle Wheels,		30	0
Length of Paddles,		11	
Depth of "	14 inches each, or	2	4
Number of double Paddles in each Wheel,	26		
Average Dip of Wheel,		2	4
Average Number of Revolutions,	24		
Average Pressure of Steam,	" lbs. 45		
Cutting off at		5	6
Two Iron Boilers (one on each guard).			
Whole Amount of Fire Surface,	2490 square feet.		
" " Grate "	100 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$14\frac{15}{100}$ to 1.		
" " " Grate Surface,	$24\frac{9}{10}$ to 1.		
Area of 1st Flues,	17 square feet.		
" 2d "	14 "		
" Chimneys,	17 "		
Height of " above Grate,	50 feet.		
Consumption of Anthracite Coal per hour,*	6000 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{54}{100}$ lbs.		
Coal per hour to a square foot of Grate,	60 "		

* Fan blast under grate.

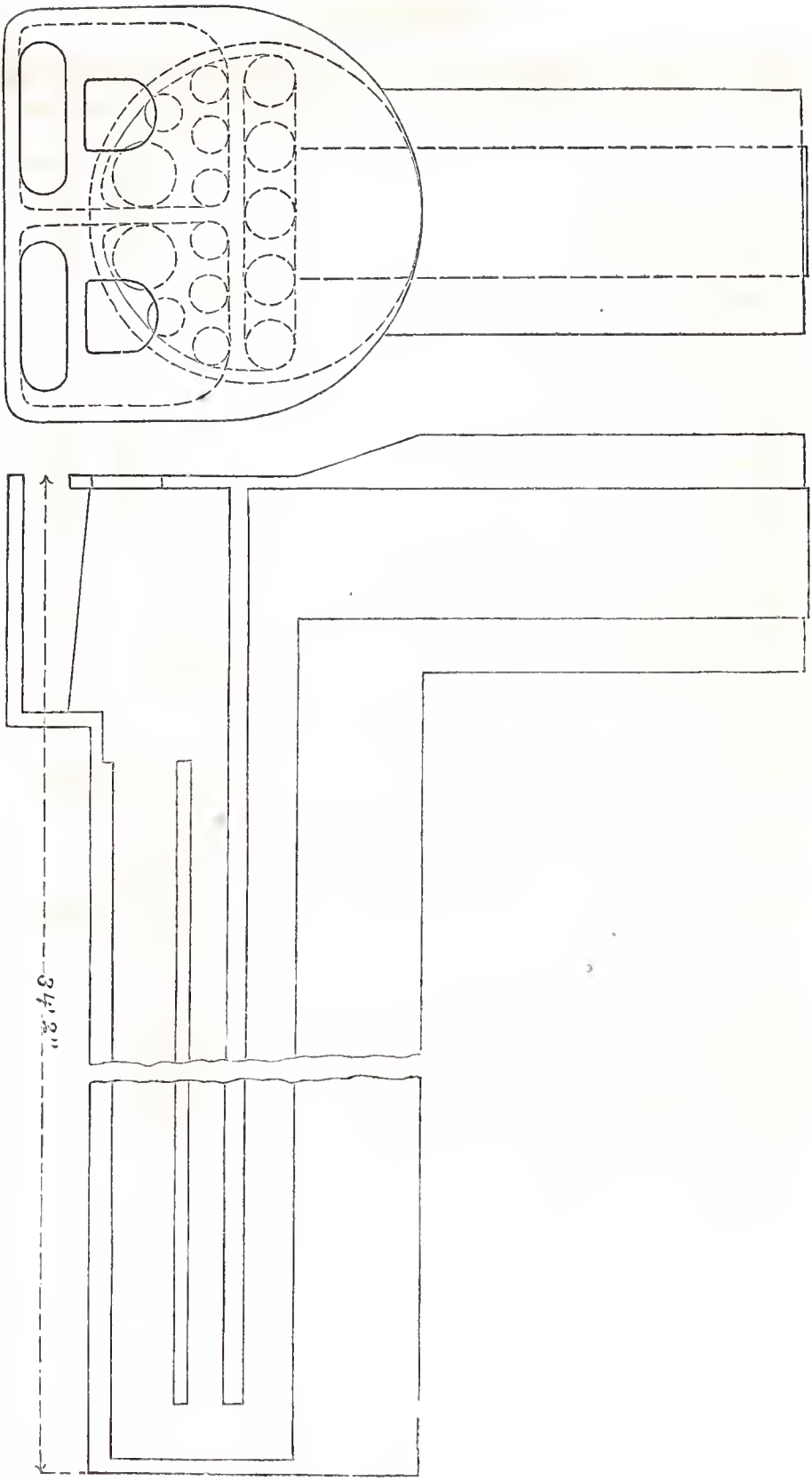
Boilers with same diameter of shell and flues, but six feet longer and one foot more front, giving increased grate surface.

OREGON.

River Steamer running from New York to Albany. Engine and Boilers designed and constructed by Stillman Allen & Co., New York.

		Feet.	Inches.
Length on Deck,		318	0
Breadth of Beam,		35	0
Depth of Hold,		10	0
Tonnage,	tons 1094		
Average Draft of Water,		6	
One Beam Engine.			
Diameter of Cylinder,		6	
Length of Stroke,		11	0
Diameter of Paddle Wheels,		34	0
Length of Paddles,		11	0
Depth of "		1	6
Number of Paddles in each Wheel,	28		
Average Dip of Wheel,		4	0
Average Number of Revolutions,	19		
Average Pressure of Steam,	30 lbs.		
Cutting off at		5	6
Two Iron Boilers, (one on each guard).			
Whole Amount of Fire Surface,	3756 square feet.		
" " Grate Surface,	120 "		
Ratio of Fire Surface to cubic foot of Cylinder,	12 to 1.		
" " " Grate Surface,	$31\frac{3}{10}$ to 1.		
Area of 1st Flues,	$21\frac{1}{4}$ square feet		
" 2d, "	14 "		
" Chimnies,	$19\frac{1}{4}$ "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	6650 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{1}{2}$ "		
Coal per hour to a square foot of Grate,	55 "		

* Fan blast under grate.

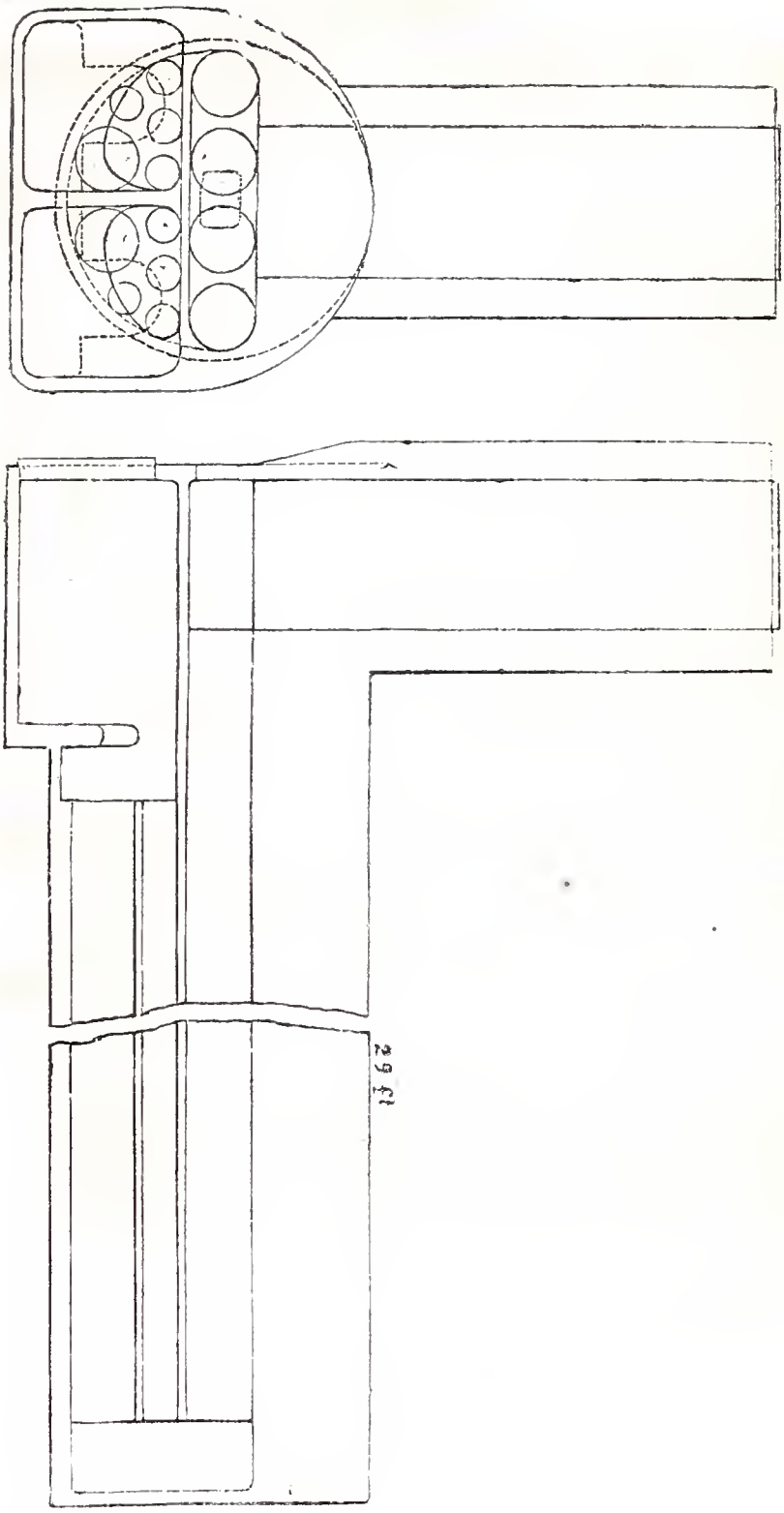

37,2''

ALIDA.

River Steamer running from New York and Albany, Engine and Boilers designed and constructed by H. R. Dunham & Co., New York.

		Feet.	Inches.
Length on Deck,		276	0
Breadth of Beam,		28	6
Depth of Hold,		9	6
Tonnage,	tons 741		
Average Draft of Water,		5	6
One Beam Engine			
Diameter of Cylinder,		4	8
Length of Stroke,		12	0
Diameter of Paddle Wheels,		32	8
Length of Paddles,		9	6
Depth of "		2	9
Number of Paddles in each Wheel,	30		
Average Dip of Wheel,		2	11
Average Number of Revolutions,	23		
Average Pressure of Steam,	lbs. 40		
Cutting off at		6	0
Two Iron Boilers (one on each guard).			
Whole Amount of Fire Surface,	2786 square feet.		
" " Grate "	100 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$13\frac{6}{10}$ to 1.		
" " " Grate Surface,	$27\frac{9}{10}$ to 1.		
Area of 1st Flues,	17 square feet.		
" 2d "	$14\frac{1}{2}$ "		
" Chimnies,	21 "		
Height of " above Grate,	50 feet.		
Consumption of Anthracite Coal per hour,*	6000 lbs.		
Water Evaporated by 1 lb. of Coal,	6 lbs.		
Coal per hour to a square foot of Grate,	60 "		

* Fan blast under grate.

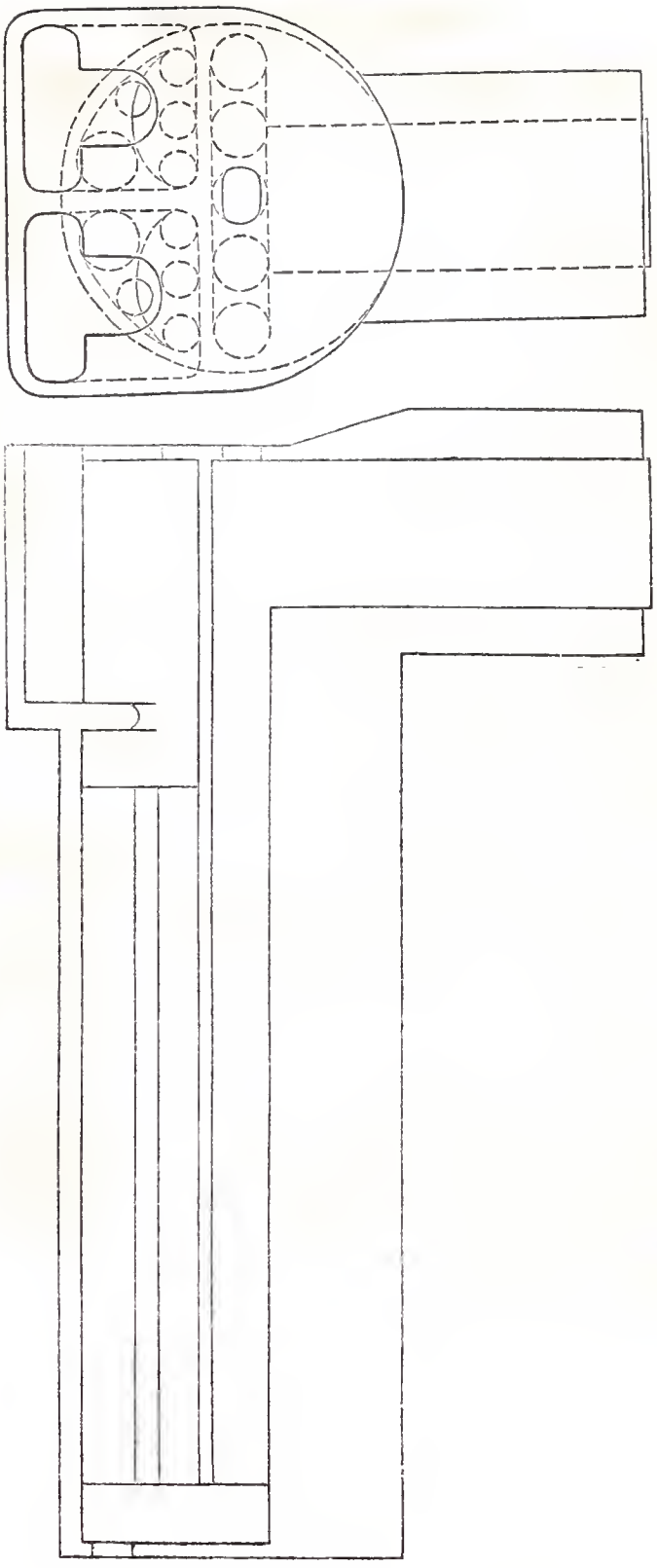


NIAGARA.

River Steamer running on the Hudson River. Engine and Boilers designed and constructed by Hogg & Delamater, New York.

		Feet.	Inches.
Length on Deck,		265	0
Breadth of Beam,		28	6
Depth of Hold,		9	3
Tonnage,	tons 688		
Draft of Water,		5	0
One Beam Engine.			
Diameter of Cylinder,		5	0
Length of Stroke,		11	0
Diameter of Paddle Wheels,		30	0
Length of Paddles,		11	0
Depth of Paddles,	15 in each or	2	6
Number of Double Paddles in each Wheel,	24		
Dip of Wheel,		2	6
Average Number of Revolutions,	22		
Average Pressure of Steam,	lbs. 40		
Cutting off at		5	6
Two Iron Boilers; one on each guard.			
Whole Amount of Fire Surface,	2696 square feet.		
" " Grate Surface,	100 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{1}{2}$ to 1.		
" " " Grate Surface,	27 to 1.		
Area of 1st Flues,	18 square feet.		
" 2d "	14 "		
" Chimnies,	21 "		
Height of " above Grate,	50 feet.		
Consumption of Anthracite Coal per hour,*	5500 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{4}{10}$ lbs.		
Coal per hour to a square foot of Grate,	55 "		

* Fan Blast under Grate.

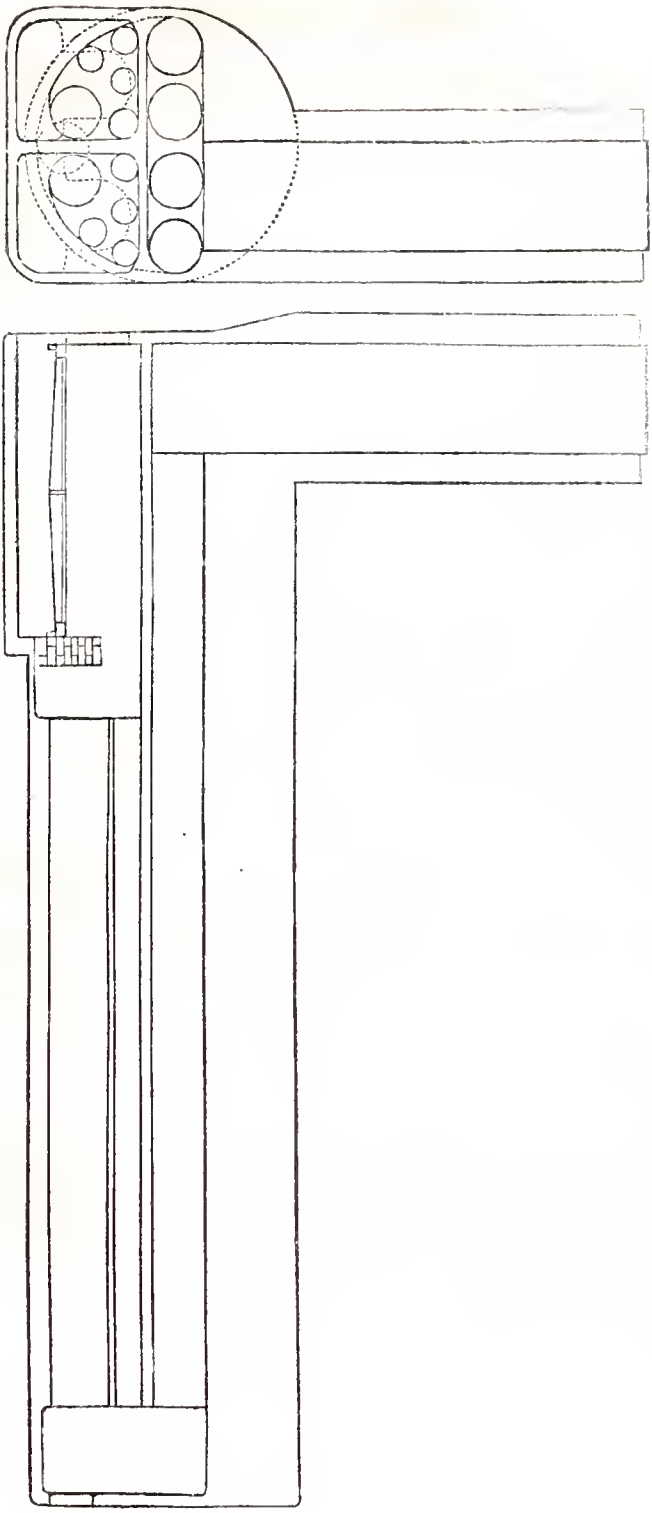


JOSEPH BELKNAP.

River Steamer running on the Hudson River. Engine and Boilers designed and constructed by H. R. Dunham & Co., New York.

		Feet.	Inches.
Length on Deck,		187	0
Breadth of Beam,		27	4
Depth of Hold,		8	0
Tonnage,	tons 391		
Draft of Water,		5	0
One Beam Engine.			
Diameter of Cylinder,		3	4
Length of Stroke,		12	0
Diameter of Paddle Wheels,		28	10
Length of Paddles,		8	0
Depth of "		2	2
Number of " in each wheel,	28		
Dip of Wheel,		2	6
Average Number of Revolutions	24		
" Pressure of Steam, "	lbs. 45		
Cutting off at		6	6
Two Iron Boilers (below deck).			
Whole Amount of Fire Surface,	2206 square feet.		
" " " Grate "	80 "		
Ratio of Fire Surface to cubic foot of Cylinder,	21 to 1.		
" " " Grate Surface,	$27\frac{1}{2}$ to 1.		
Area of 1st Flues,	12 square feet.		
" 2d "	10 "		
" Chimney,	10 "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	2800 lbs.		
Water Evaporated by 1 lb. of Coal,	$7\frac{8}{10}$ lbs.		
Coal per hour to a square foot of Grate,	35 "		

* Fan Blast under Grate.

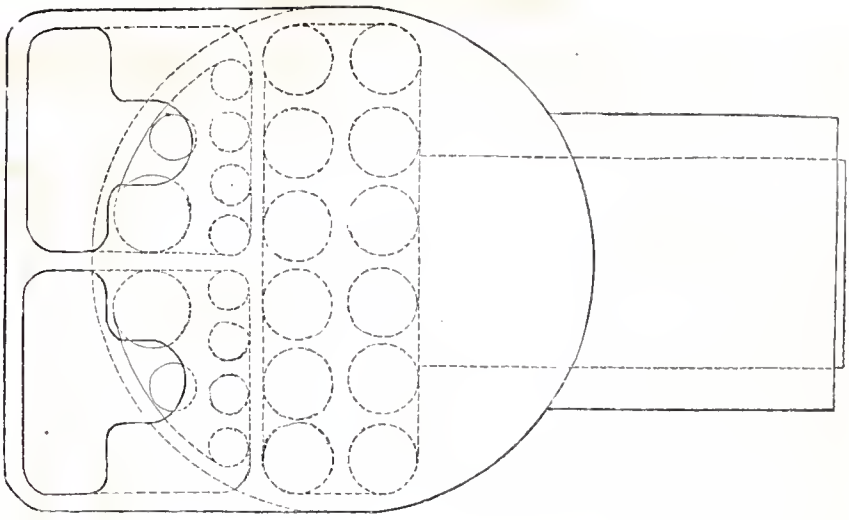


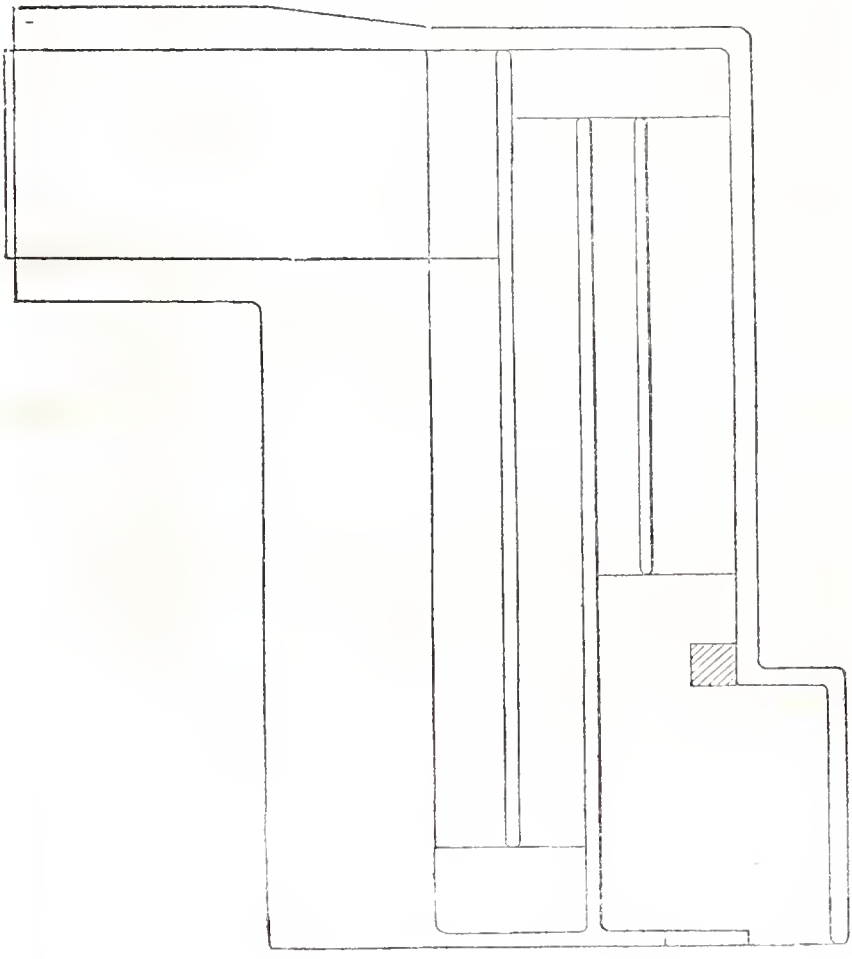
MOUNTAINEER.

River Steamer, running on the Hudson River. Engine and Boiler designed and constructed by Joseph E. Coffee, Esq., New York.

		Feet.	Inches.
Length on Deck,		230	0
Breadth of Beam,		24	0
Depth of Hold,		9	0
Tonnage,	tons 491		
Draft of Water,		4	6
One Beam Engine.			
Diameter of Cylinder,		4	6
Length of Stroke,		11	0
Diameter of Paddle Wheels,		29	6
Length of Paddles,		9	6
Depth of "		2	0
Number of Paddles in each Wheel,	24		
Dip of Wheel,		2	0
Average Number of Revolutions,	24		
" Pressure of Steam,	lbs. 36		
Cutting off at		6	0
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	2114 square feet.		
" " Grate "	66 "		
Ratio of Fire Surface to cubic foot of Cylinder,	12 to 1.		
" " " Grate Surface,	32 to 1.		
Area of 1st Flues,	13 square feet.		
" 2d and 3d Flues, each,	13 "		
" Chimney,	$19\frac{6}{10}$ "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	5000 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{2}{10}$ "		
Coal per hour to a square foot of Grate,	76 "		

* Fan Blast under Grate.



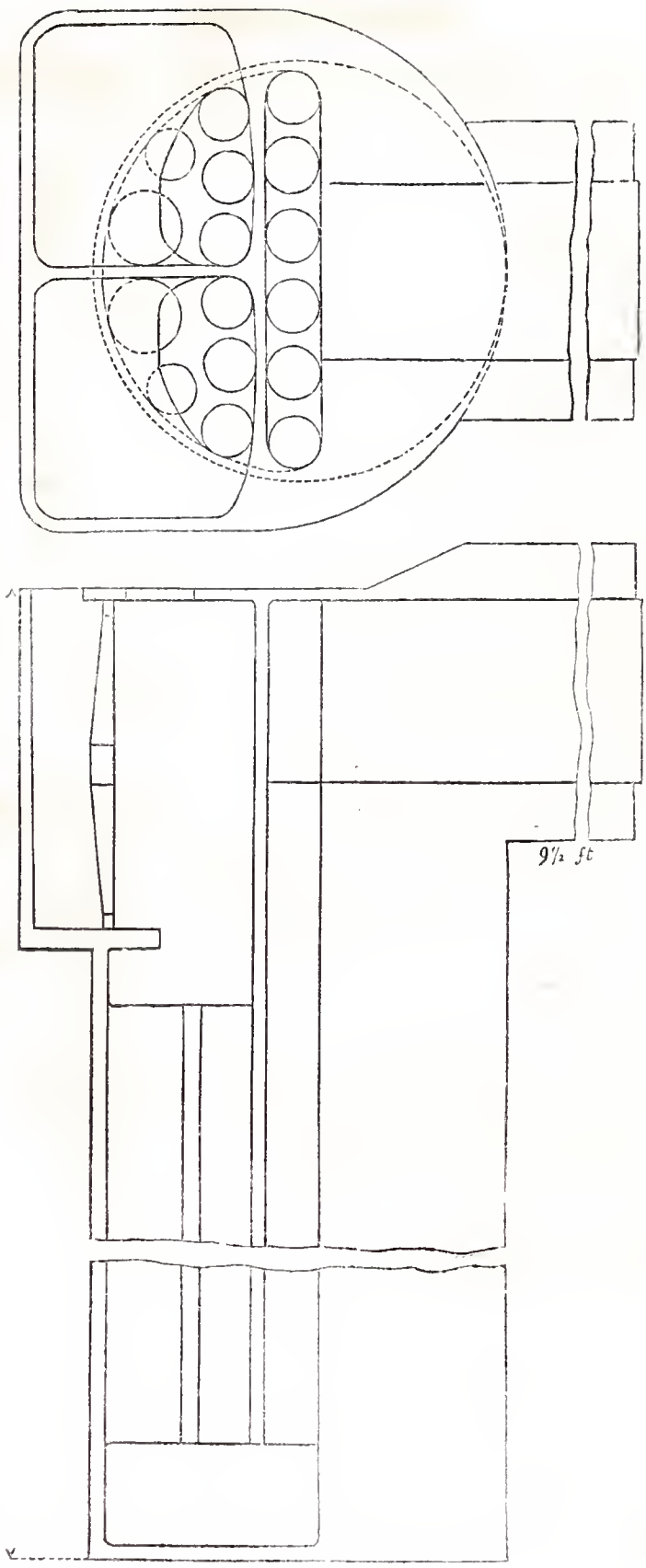


NEW WORLD.

River Steamer running from New York to Albany. Engine and Boilers designed and constructed by T. F. Secor & Co., New York.

		Feet.	Inches.
Length on Deck,		371	0
Breadth of Beam,		35	0
Depth of Hold,		11	0
Tonnage,	tons 1418		
Draft of Water,		5	6
One Beam Engine.			
Diameter of Cylinder,		6	4
Length of Stroke,		15	0
Diameter of Paddle Wheels,		45	0
Length of Paddles,		12	0
Depth "		1	6
Number of Paddles in each Wheel,	38		
Dip of Wheel,		3	4
Average Number of Revolutions,	17		
Average Pressure of Steam,	lbs. 45		
Cutting off at		8	0
Two Iron Boilers; one on each guard.			
Whole Amount of Fire Surface,	5338 square feet.		
" " Grate "	212 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$11\frac{3}{10}$ to 1.		
" " " Grate Surface,	$25\frac{1}{8}$ to 1.		
Area of 1st Flues,	34 square feet.		
" 2d "	20 "		
" Chimnies,	34 "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	9000 lbs.		
Water Evaporated by 1 lb. of Coal,	7 "		
Coal per hour to a square foot of Grate,	$42\frac{5}{10}$ "		

* Fan Blast under Grate.

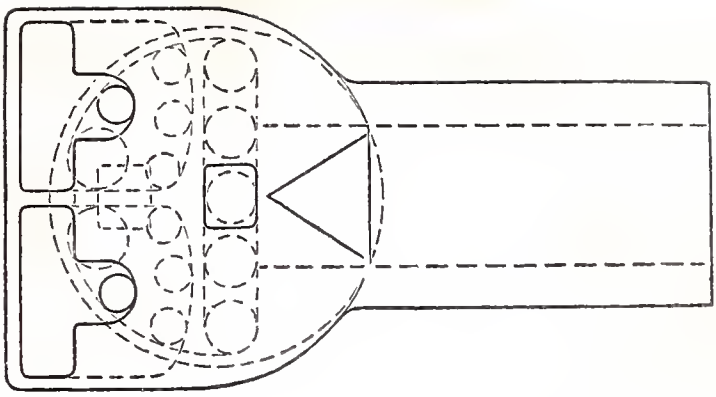

9½ ft

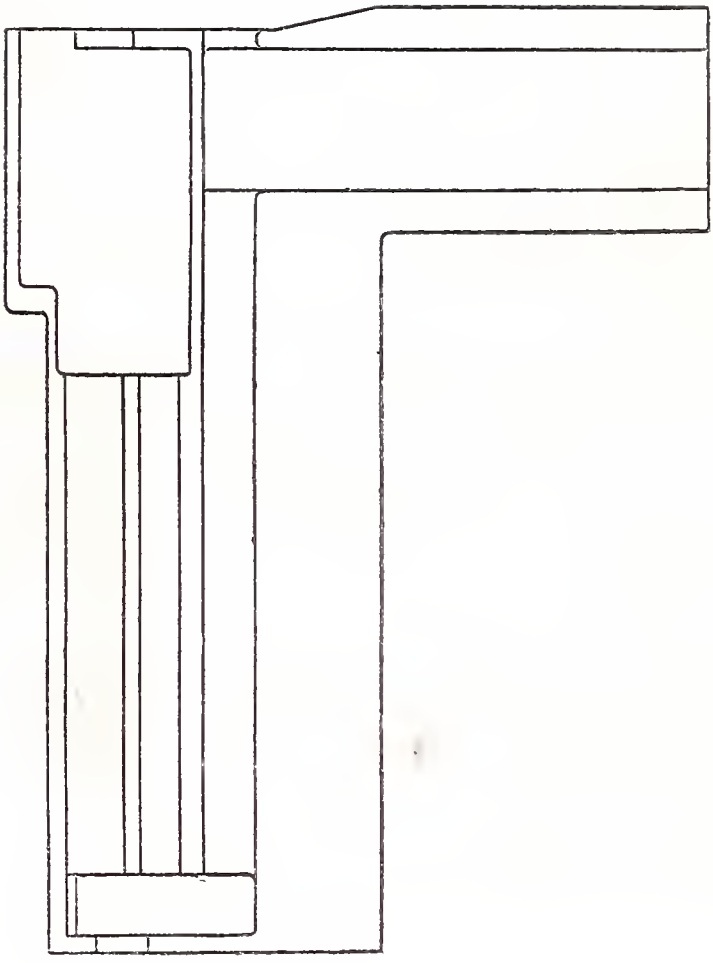
TRAVELLER.

River Steamer running on Long Island Sound, from New York to New Haven. Engine and Boilers designed and constructed by the Allaire Works, New York.

		Feet.	Inches.
Length on Deck,		225	0
Breadth of Beam,		29	0
Depth of Hold,		9	6
Tonnage,	tons	600	
Draft of Water,		5	0
One Beam Engine,			
Diameter of Cylinder,		4	4
Length of Stroke,		11	0
Diameter of Paddle Wheels,		29	3
Length of Paddles,		8	0
Depth of "		2	4
Number of Paddles in each Wheel,	20		
Dip of Wheel,		3	0
Average Number of Revolutions,	24		
Average Pressure of Steam,	lbs. 30		
Cutting off at		5	6
Two Iron Boilers (one on each guard).			
Whole Amount of Fire Surface,	2030 square feet.		
" " Grate "	95 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$12\frac{1}{2}$ to 1.		
" " " Grate Surface	$21\frac{3}{10}$ to 1.		
Area of 1st Flues,	$18\frac{1}{2}$ square feet.		
" 2d "	$12\frac{6}{10}$ "		
" Chimnies,	$17\frac{4}{10}$ "		
Height of " above Grate,	40 feet.		
Consumption of Anthracite Coal per hour,*	4000 lbs.		
Water Evaporated by 1 lb. of Coal,	6		
Coal per hour to a square foot of Grate,	42 "		

* Fan Blast under Grate.



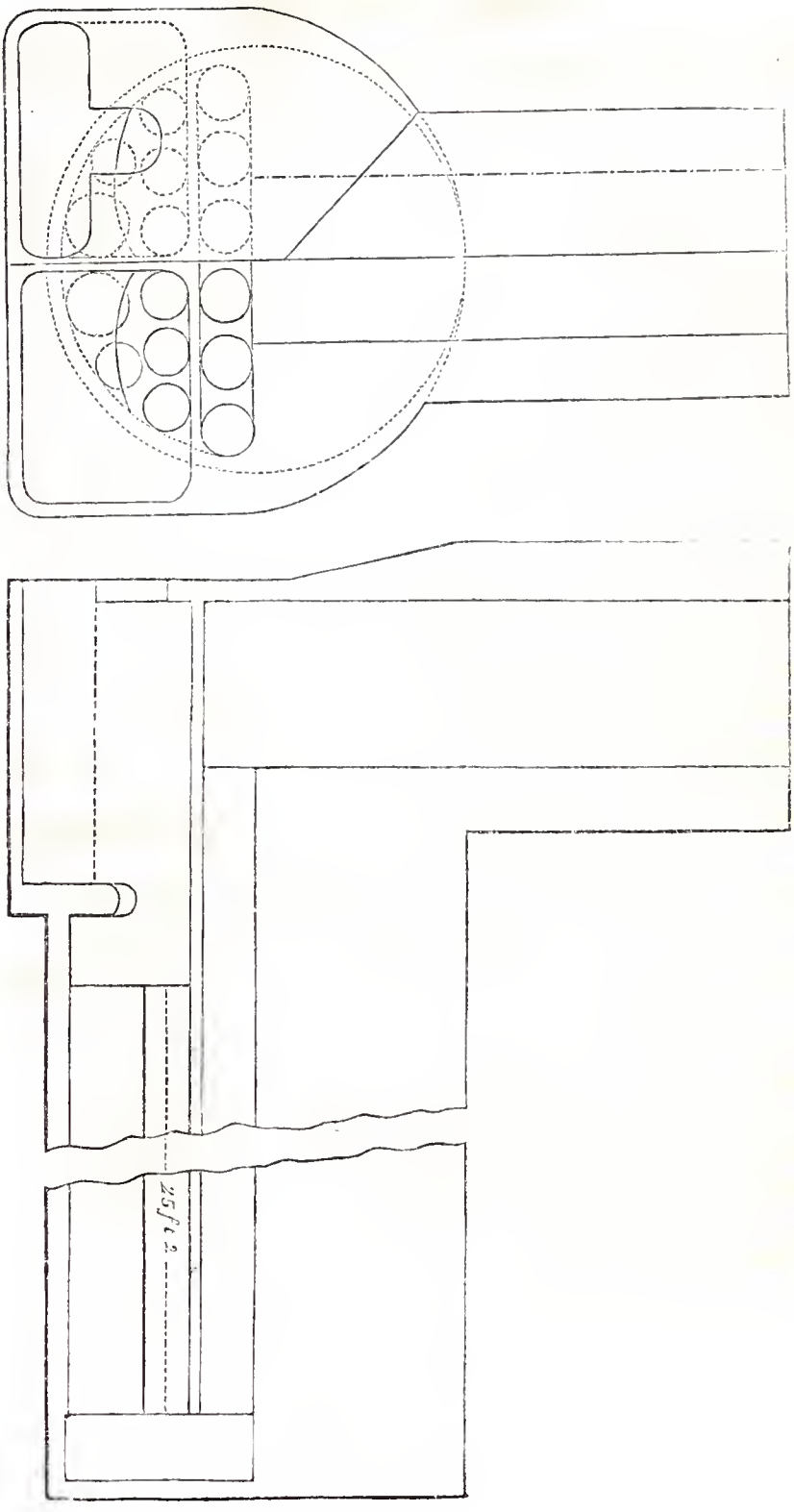


ISAAC NEWTON.

River Steamer running on the Hudson. Engine and Boilers designed and constructed at the Allaire Works, New York.

		Feet.	Inches.
Length on Deck,		338	0
Breadth of Beam,		40	0
Depth of Hold,		11	0
Tonnage,	tons 1454		
Draft of Water,		5	0
One Beam Engine			
Diameter of Cylinder,		6	9
Length of Stroke,		12	0
Diameter of Paddle Wheels,		39	0
Length of Paddles,		12	0
Depth of " 18 inches each, or		3	0
Number of Double Paddles in each Wheel,	32		
Dip of Wheel,		4	0
Average Number of Revolutions,	17		
Average Pressure of Steam,	lbs. 35		
Cutting off at		6	0
Two Iron Boilers (one on each guard).			
Whole Amount of Fire Surface,	4540 square feet.		
" " Grate "	161 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$10\frac{6}{10}$ to 1.		
" " " Grate Surface,	$28\frac{2}{10}$ to 1.		
Area of 1st Flues,	$27\frac{4}{10}$ square feet.		
" 2d "	$17\frac{2}{10}$ "		
" Chimnies,	26 "		
Height of " above Grate,	65 feet.		
Consumption of Anthracite Coal per hour,*	8000 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{2}{10}$ lbs.		
Coal per hour to a square foot of Grate,	50 "		

* Fan blast under grate.

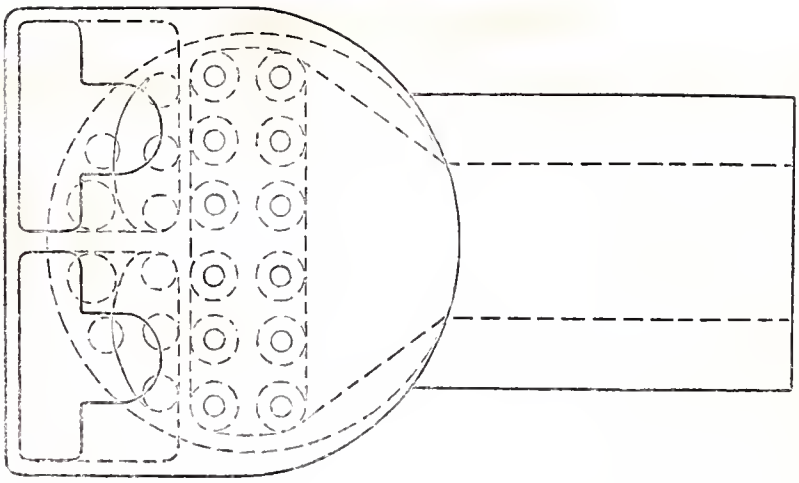


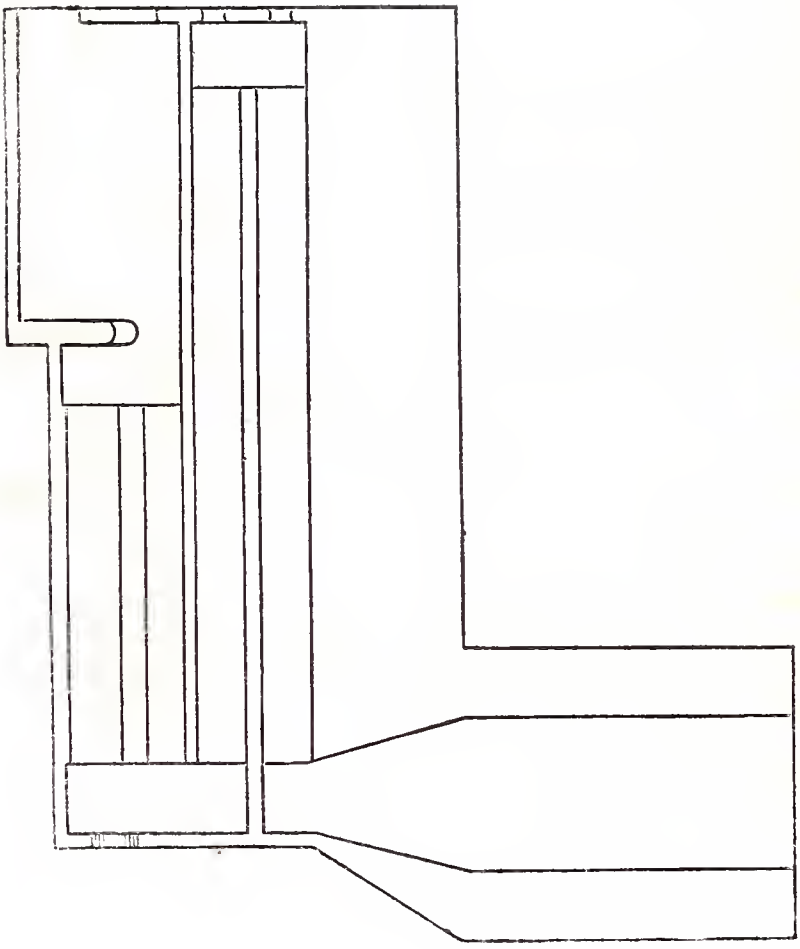
ROGER WILLIAMS.

River Steamer running on the Hudson. Engine and Boiler designed and constructed by H. R. Dunham & Co., New York.

		Feet.	Inches.
Length on Deck,		212	0
Breadth of Beam,		27	0
Depth of Hold,		9	0
Tonnage,	tons 501		
Draft of Water,		5	6
One Beam Engine.			
Diameter of Cylinder,		3	8
Length of Stroke,		11	0
Diameter of Paddle Wheels,		28	7
Length of Paddles,		8	2
Depth of "		2	6
Number of Paddles in each Wheel,	22		
Dip of Wheel,		3	0
Average Number of Revolutions,	22		
Average Pressure of Steam,	" lbs. 28		
Cutting off at		6	6
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	1384 square feet.		
" " Grate "	72 "		
Ratio of Fire Surface to cubic foot of Cylinder,	12 to 1.		
" " " Grate Surface,	$19\frac{2}{10}$ to 1.		
Area of 1st Flues,	$8\frac{2}{10}$ square feet.		
" 2d "	$6\frac{1}{2}$ "		
" Chimney,	$10\frac{1}{2}$ "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	3000 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{9}{10}$ lbs.		
Coal per hour to a square foot of Grate,	41 "		

* Fan blast under grate.



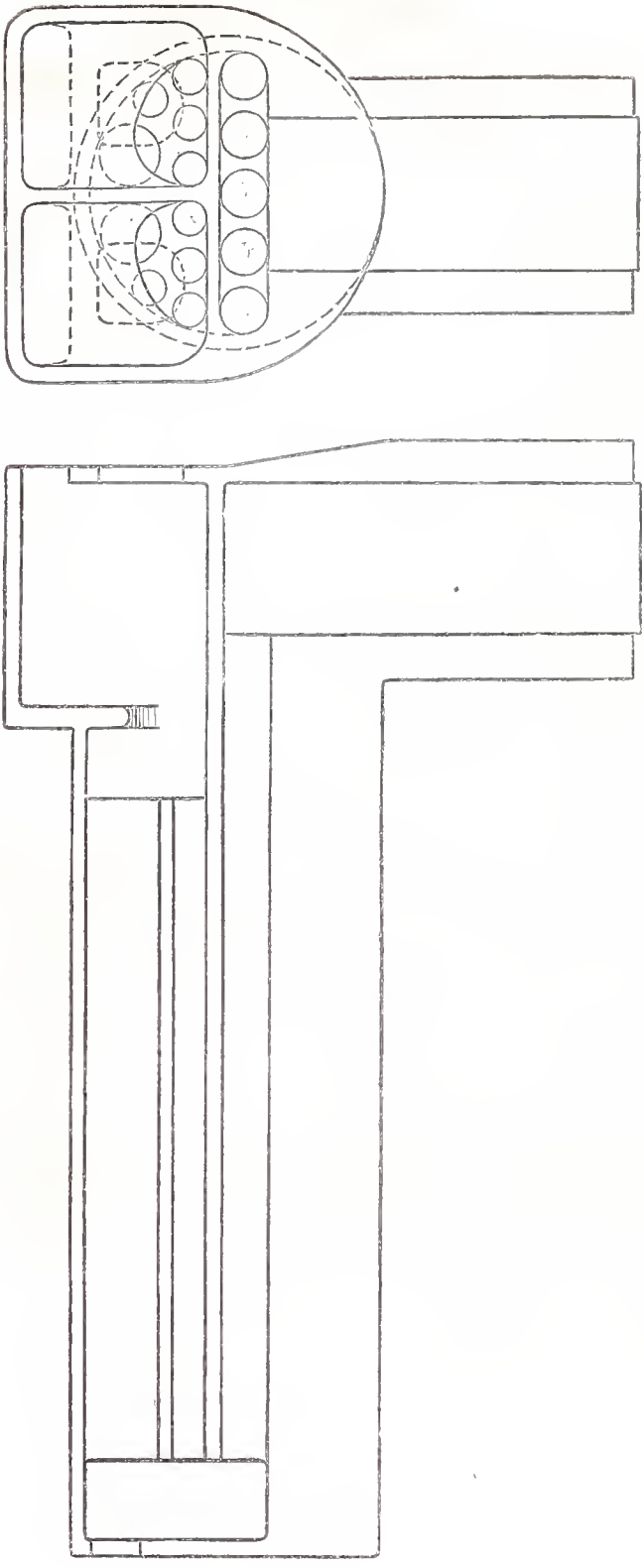


THOMAS POWELL.

River Steamer running on the Hudson. Engine and Boilers designed and constructed by T. F. Secor & Co., New York.

		Feet.	Inches.
Length on Deck,		225	0
Breadth of Beam,		28	0
Depth of Hold,		9	6
Tonnage,	tons 582		
Draft of Water,		4	6
One Beam Engine.			
Diameter of Cylinder,		4	
Length of Stroke,		11	0
Diameter of Paddle Wheels,		29	6
Length of Paddles,		9	0
Depth of "		2	0
Number of Paddles in each Wheel,	24		
Dip of Wheel,		2	0
Average Number of Revolutions,	24		
Average Pressure of Steam,	50 lbs.		
Cutting off at		8	0
Two Iron Boilers, (one on each guard).			
Whole Amount of Fire Surface,	2244 square feet.		
" " Grate Surface,	88 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$16\frac{1}{4}$ to 1.		
" " " Grate Surface,	$25\frac{1}{2}$ to 1.		
Area of 1st Flues,	15 square feet		
" 2d, "	10 "		
" Chimnies,	16 "		
Height of " above Grate,	50 feet.		
Consumption of Anthracite Coal per hour,*	6000 lbs.		
Water Evaporated by 1 lb. of Coal,	$6\frac{6}{10}$ "		
Coal per hour to a square foot of Grate,	68 "		

* Fan blast under grate.

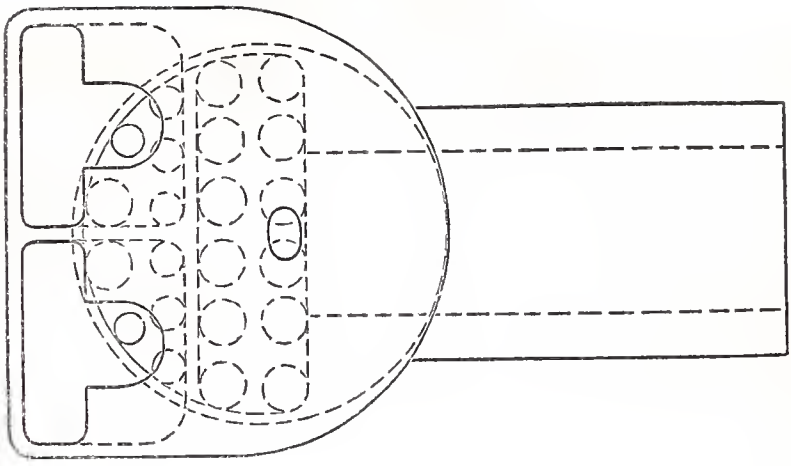


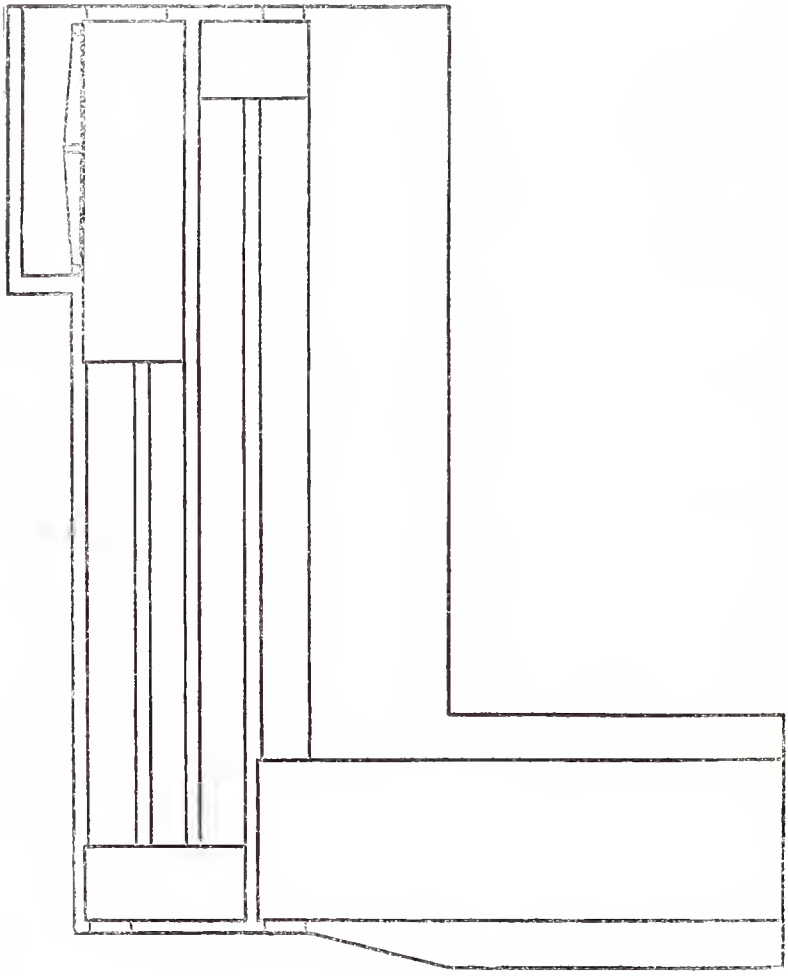
ARMENIA.

River Steamer running on the Hudson River. Engine and Boiler designed and constructed by H. R. Dunham & Co., New York.

		Feet.	Inches.
Length on Deck,		185	0
Breadth of Beam,		28	0
Depth of Hold,		8	6
Tonnage,	tons 421		
Draft of Water,		3	9
One Beam Engine.			
Diameter of Cylinder,		2	10
Length of Stroke,		14	0
Diameter of Paddle Wheels,		29	4
Length of Paddles,		8	3
Depth of "		2	4
Number of Paddles in each Wheel,	26		
Dip of Wheel,		2	4
Average Number of Revolutions,	23		
" Pressure of Steam,	lbs. 35		
Cutting off at		10	0
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	1402 square feet.		
" " Grate "	57 "		
Ratio of Fire Surface to cubic foot of Cylinder,	16 to 1.		
" " " Grate Surface,	$24\frac{1}{2}$ to 1.		
Area of 1st Flues,	$7\frac{1}{4}$ square feet.		
" 2d and 3d Flues, each,	$5\frac{1}{2}$ "		
" Chimney,	$11\frac{1}{2}$ "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	2500 lbs.		
Water Evaporated by 1 lb. of Coal,	7 "		
Coal per hour to a square foot of Grate,	44 "		

* Fan blast under grate.



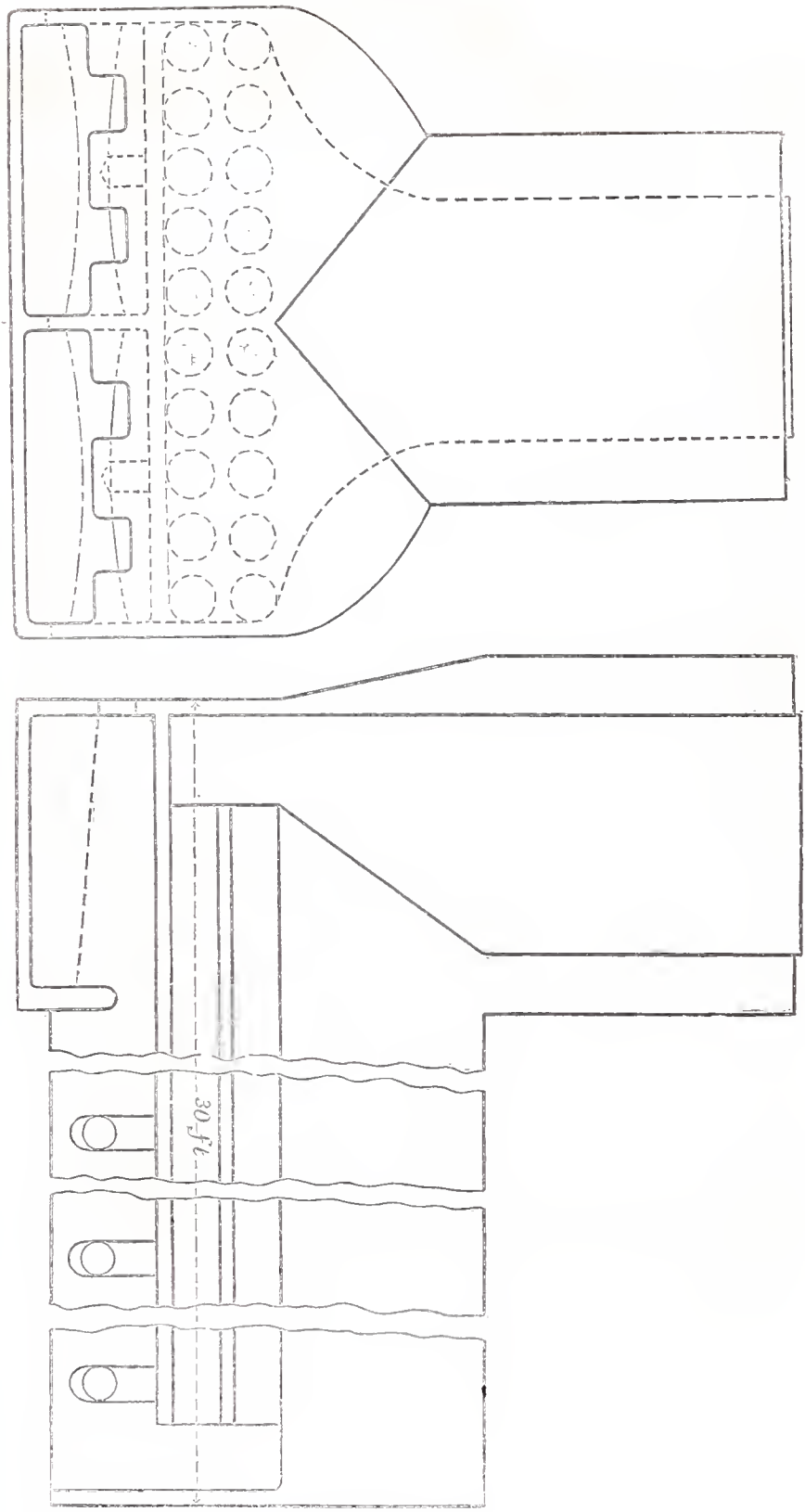


AMERICA.

River Steamer running on the Delaware River. Engine and Boiler designed and constructed by I. P. Morris & Co., Philadelphia.

	Feet.	Inches.
Length on Deck,	216	0
Breadth of Beam,	30	0
Depth of Hold,	8	0
Tonnage,	tons 508	
Draft of Water,	4	0
One Beam Engine.		
Diameter of Cylinder,	3	8
Length of Stroke,	12	0
Diameter of Paddle Wheels,	30	0
Length of Paddles,*	9	0
Depth "	2	0
Number of Paddles in each Wheel,	40	
Dip of Wheel,	2	0
Average Number of Revolutions,	23	
Average Pressure of Steam,	lbs. 25	
Cutting off at	9	0
One Iron Boiler (below deck).		
Whole Amount of Fire Surface,	2753 square feet.	
" " Grate "	105 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$21\frac{7}{10}$ to 1.	
" " " Grate Surface,	26 to 1.	
Area of 1st Flues,	14 square feet.	
" 2d "	20 "	
" Chimney,	28 "	
Height of " above Grate,	60 feet.	
Consumption of Anthracite Coal per hour,	3100 lbs.	
Water Evaporated by 1 lb. of Coal,	$7\frac{82}{100}$ lbs.	
Coal per hour to a square foot of Grate,	$29\frac{1}{2}$ "	

* There were two rows of 20 paddles in each wheel; each paddle being 4 feet 10 inches long, but lapping each other so as to present a surface of but 9 feet in length.

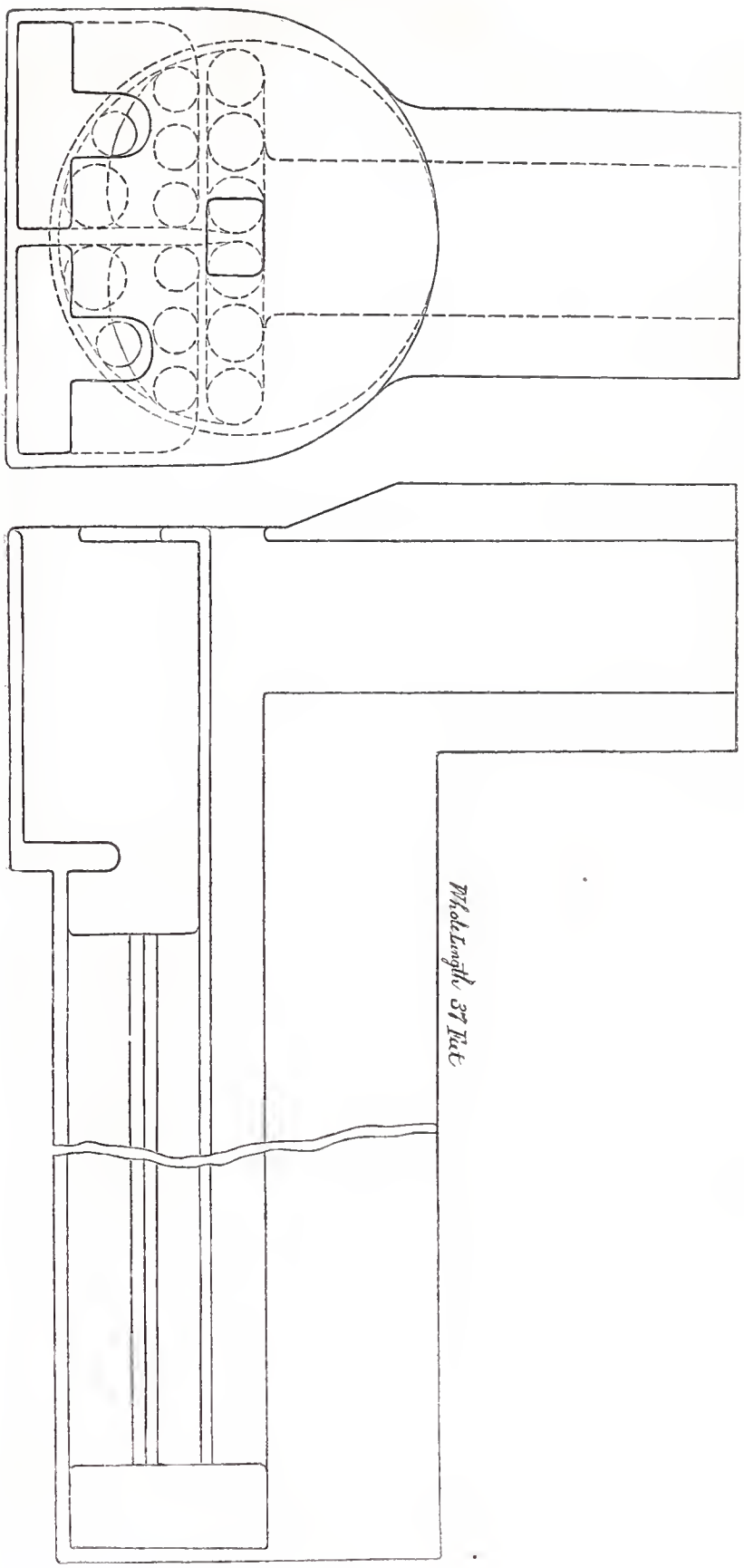

30 ft.

BAY STATE.

River Steamer running on Long Island Sound from New York to Fall River. Engine and Boilers designed and constructed at the Allaire Works, New York.

		Feet.	Inches.
Length on Deck,		300	0
Breadth of Beam,		39	0
Depth of Hold,		13	2
Tonnage,	tons 1492		
Draft of Water,		8	0
One Beam Engine.			
Diameter of Cylinder,		6	4
Length of Stroke,		12	0
Diameter of Paddle Wheels,		38	0
Length of Paddles,		10	3
Depth of Paddles,		2	8
Number of Paddles in each Wheel,	30		
Dip of Wheel,		3	6
Average Number of Revolutions,	18		
Average Pressure of Steam,	lbs. 25		
Cutting off at		6	0
Two Iron Boilers (one on each guard).			
Whole Amount of Fire Surface,	4554 square feet.		
" " Grate Surface,	173 "		
Ratio of Fire Surface to cubic foot of Cylinder,	12 to 1.		
" " " Grate Surface,	$29\frac{5}{10}$ to 1.		
Area of 1st Flues,	$26\frac{3}{4}$ square feet.		
" 2d "	$18\frac{9}{10}$ "		
" Chimnies,	25 "		
Height of " above Grate,	60 feet.		
Consumption of Anthracite Coal per hour,*	6500 lbs.		
Water Evaporated by 1 lb. of Coal,	$5\frac{82}{100}$ lbs.		
Coal per hour to a square foot of Grate,	38 "		

* Fan Blast under Grate.

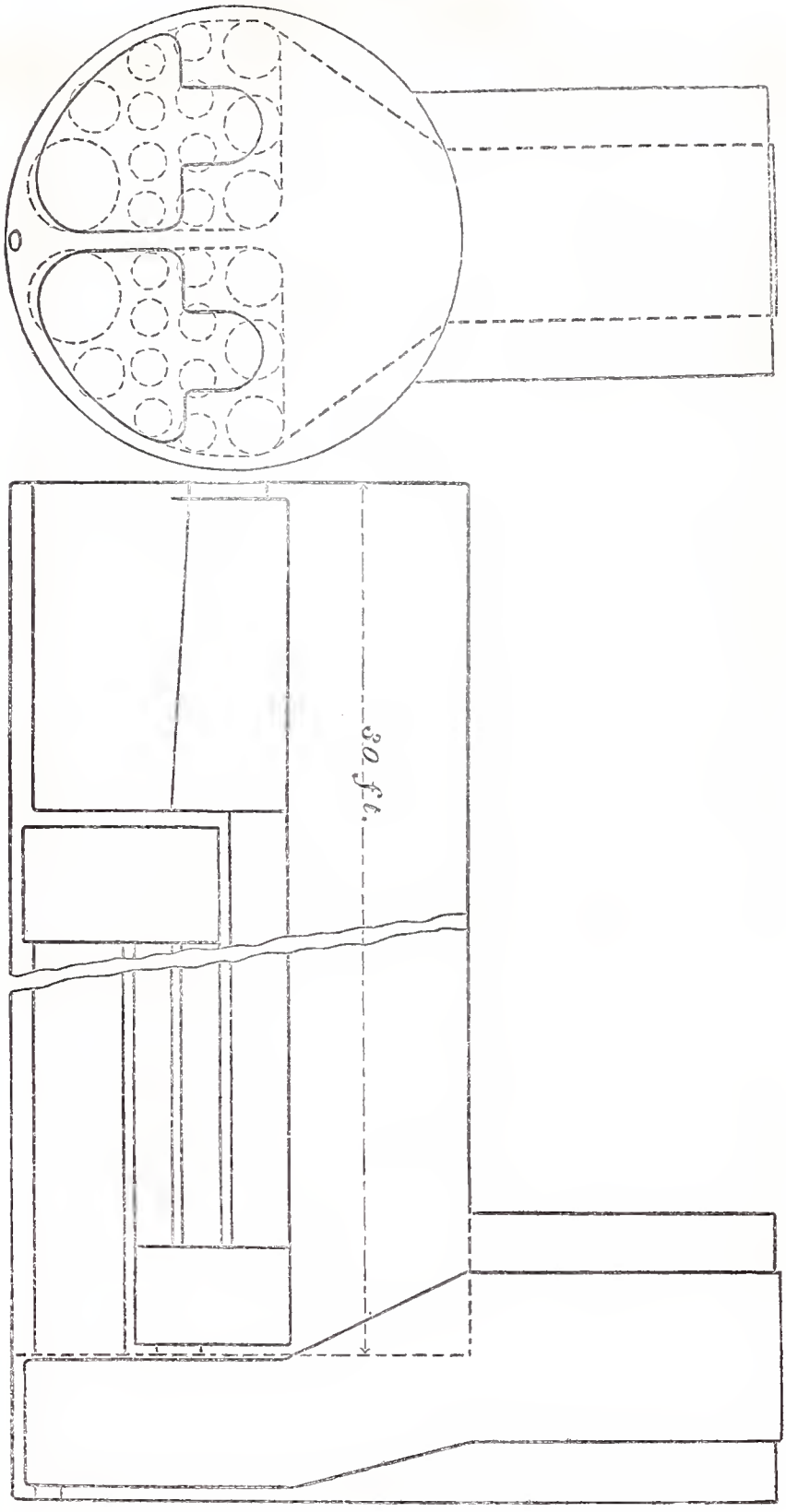

Whole Length 37 Feet

EMPIRE STATE.

River Steamer running on Long Island Sound from New York to Fall River. Engine and Boilers designed and constructed by the Allaire Works, New York.

	Feet.	Inches.
Length on Deck,	304	0
Breadth of Beam,	39	0
Depth of Hold,	13	6
Tonnage,	tons 1551	
Draft of Water,	8	0
One Beam Engine.		
Diameter of Cylinder,	6	4
Length of Stroke,	12	0
Diameter of Paddle Wheels,	38	0
Length of Paddles,	10	3
Depth of "	2	8
Number of " in each wheel,	30	
Dip of Wheel,	3	6
Average Number of Revolutions	18	
" Pressure of Steam, "	lbs. 25	
Cutting off at	6	0
Two Iron Boilers (one on each guard).		
Whole Amount of Fire Surface,	4160 square feet.	
" " " Grate "	166 "	
Ratio of Fire Surface to cubic foot of Cylinder,	11 to 1.	
" " " Grate Surface,	25 to 1.	
Area of 1st Flues,	$18\frac{8}{10}$ square feet.	
" 2d "	25 "	
" 3d "	$22\frac{6}{10}$ "	
" Chimnies,	32 "	
Height of " above Grate,	60 feet.	
Consumption of Anthracite Coal per hour,*	6500 lbs.	
Water Evaporated by 1 lb. of Coal,	$5\frac{82}{100}$ lbs.	
Coal per hour to a square foot of Grate,	$39\frac{1}{10}$ "	

* Fan Blast under Grate.



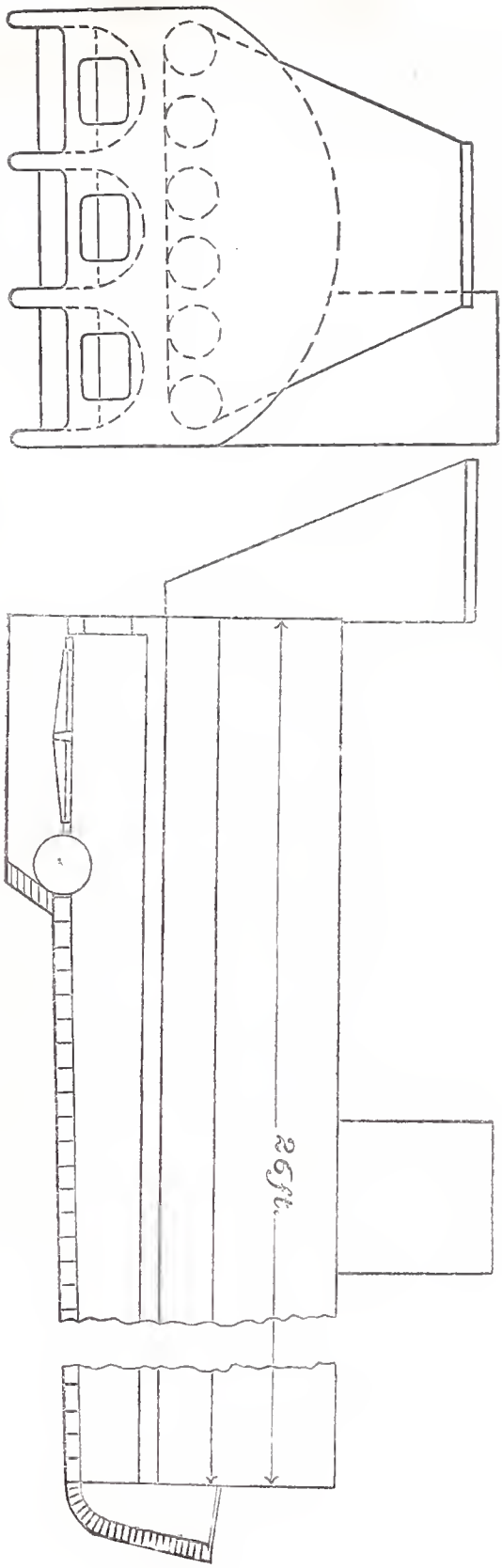
15

ANGLO SAXON.

Steam Tug used on the Mississippi below New Orleans. Engines and Boilers designed and constructed by H. R. Dunham & Co., New York.

	Feet.	Inches.
Length on Deck,	170	0
Breadth of Beam,	28	0
Depth of Hold,	11	0
Tonnage,	tons 500	
Draft of Water,	7	6
Two Engines, slightly inclined,		
Diameter of Cylinder,	4	2
Length of Stroke,	8	0
Diameter of Paddle Wheels,	24	0
Length of Paddles,	9	0
Depth of "	2	6
Number of Paddles in each Wheel,	22	
Dip of Wheel,	2	6
Average Number of Revolutions,*	22	
Average Pressure of Steam,*	lbs. 25	
Cutting off at	4	0
Two Iron Boilers on Deck.		
Whole Amount of Fire Surface,	2200 square feet.	
" " Grate "	95 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$10\frac{11}{10}$ to 1.	
" " " Grate Surface,	23 to 1.	
Area of 1st Flues, at Bridge,	18 square feet.	
" 2d "	17 "	
" Chimnies,	27 "	
Height of " above Grate,	50 feet.	
Consumption of Anthracite Coal per hour,	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* Results from trial trip, fuel not ascertained.


25 Ft.

MAY FLOWER.

Merchant Steamer on Lake Erie, running from Buffalo to Detroit. Engine and Boilers designed by Hogg & Delamater, and constructed by the West Point Foundry.

	Feet.	Inches.
Length on Deck,	288	0
Breadth of Beam,	35	6
Depth of Hold,	12	6
Tonnage,	tons 1242	
Draft of Water,	8	0
One Beam Engine.		
Diameter of Cylinder,	6	
Length of Stroke,	11	0
Diameter of Paddle Wheels,	35	0
Length of Paddles,	11	0
Depth of " 18 inches each, or	3	0
Number of Double Paddles in each Wheel,	28	
Dip of Wheel,	4	0
Average Number of Revolutions,	17	
Average Pressure of Steam,	36 lbs.	
Cutting off at	8	0
Three Iron Boilers (below deck, with two chimnies).		
Whole Amount of Fire Surface,	4791 square feet.	
" " Grate Surface,	151 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$15\frac{4}{10}$ to 1.	
" " " Grate Surface,	$31\frac{7}{10}$ to 1.	
Area of 1st Flues,	$31\frac{2}{10}$ square feet	
" 2d, "	27 "	
" Chimnies,	$39\frac{1}{4}$ "	
Height of " above Grate,	60 feet.	
Consumption of Bituminous Coal per hour,	6160 lbs.	
Water Evaporated by 1 lb. of Coal,	$6\frac{3}{10}$ "	
Coal per hour to a square foot of Grate,	$40\frac{8}{10}$ "	

Three Boilers of the same form and diameter as those used on board the Steamer Falcon, their length being increased to 30 feet.

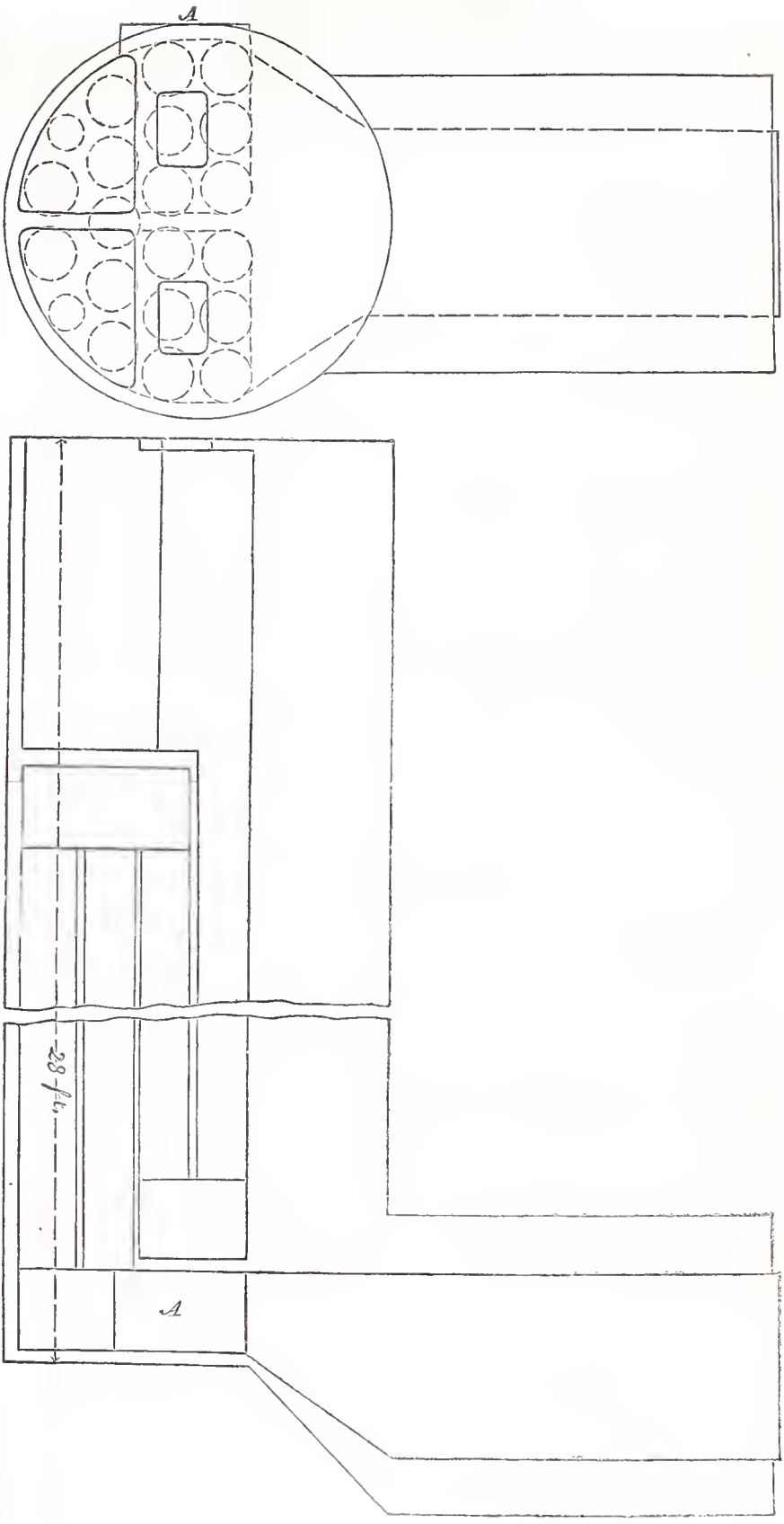
EMPIRE STATE.

(ON LAKE ERIE.)

Merchant Steamer running from Buffalo to Chicago. Engine designed by Erastus W. Smith, Esq., and constructed by Merrick & Towne, of Philadelphia. Boilers by Merrick & Towne.

	Feet.	Inches.
Length on Deck,	310	0
Breadth of Beam,	37	0
Depth of Hold,	14	7
Tonnage,	tons 1570	
Draft of Water, when light,	7	3
One Beam Engine.		
Diameter of Cylinder,	6	4
Length of Stroke,	12	0
Diameter of Paddle Wheels,	38	0
Length of Paddles,	10	0
Depth of "	2	6
Number of Paddles in each Wheel,	32	
Dip of Wheel, when light,	3	4
Average Number of Revolutions,	16	
Average Pressure of Steam,	lbs. 30	
Cutting off at	6	0
Three Iron Boilers, below deck.*		
Whole Amount of Fire Surface,	5286 square feet.	
" " " Grate "	216 "	
Ratio of Fire Surface to cubic foot of Cylinder,	14 to 1.	
" " " Grate Surface	$24\frac{5}{10}$ to 1.	
Area of 1st Flues,	$26\frac{7}{10}$ square feet.	
" 2d "	$28\frac{2}{10}$ "	
" 3d "	$39\frac{9}{10}$ "	
" Chimnies,	$39\frac{9}{10}$ "	
Height of " above Grate,	75 feet.	
Consumption of Bituminous Coal per hour,	5600 lbs.	
Water Evaporated by 1 lb. of Coal,	$6\frac{1}{2}$ "	
Coal per hour to a square foot of Grate,	26 "	

*There are two chimnies, one on each side of Boiler; the centre Boiler connecting to the side Boilers by the flue A A.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28 ft.
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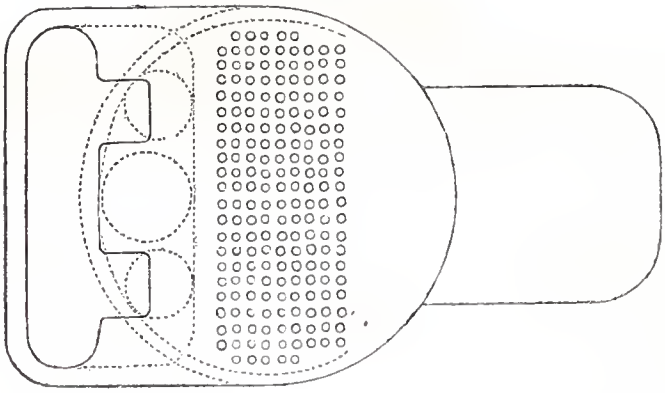
BUCK EYE STATE.*

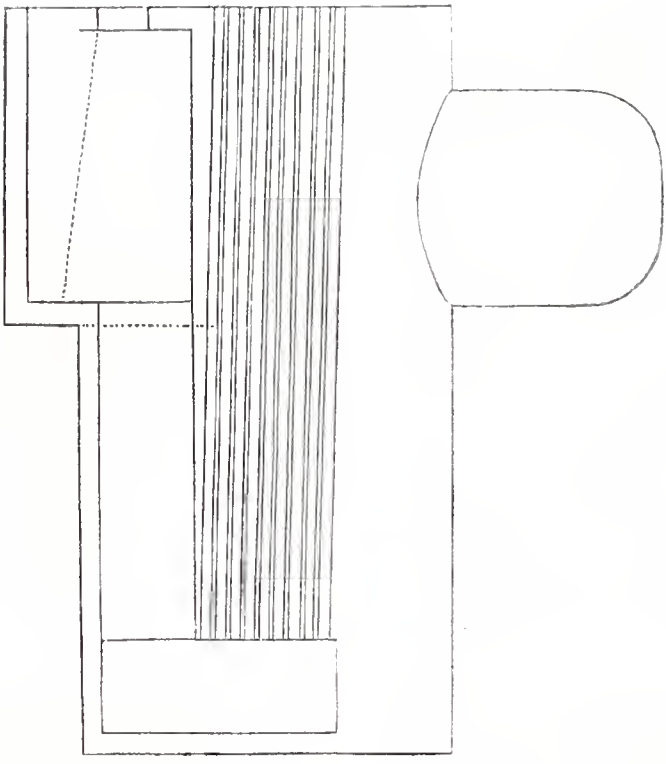
Merchant Steamer on Lake Erie to run from Buffalo to Cleveland. Engine and Boilers designed by Erastus W. Smith, Esq., New York.

	Feet.	Inches.
Length on Deck,	282	0
Breadth of Beam,	32	11
Depth of Hold,	13	0
Tonnage, tons	1187	
Draft of Water,	—	—
One Double Cylinder Annular Beam Engine.†		
Diameter of Small Cylinder,	3	1
" Large "	6	8
Length of Stroke,	11	0
Diameter of Paddle Wheels,	35	
Length of Paddles,	9	8
Depth of "	2	2
Number of Paddles in each Wheel,	30	
Average Dip of Wheel (estimated,)	3	10
Average Number of Revolutions,	—	
Average Pressure of Steam,	—	
Three Iron Boilers (below deck).		
Whole Amount of Fire Surface,	8055 square feet.	
" " Grate "	159 "	
Ratio of Fire Surface to cubic ft of Small Cylinder,	100 to 1.	
" " " Grate Surface,	$50\frac{1}{2}$ to 1.	
Area of 1st Flues,	24 square feet.	
" Tubes	28 "	
" Chimnies,	$39\frac{9}{10}$ "	
Height of " above Grate,	75 feet.	
Consumption of Bituminous Coal per hour,	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* Not yet finished.

† The Steam from the Boiler is used full stroke in the small cylinder, and expanded into the larger.



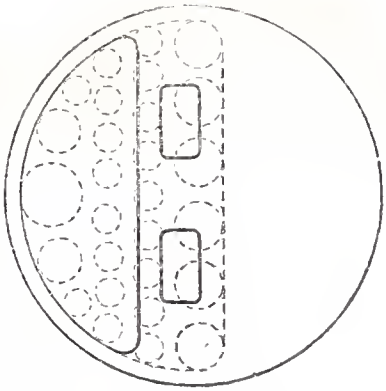


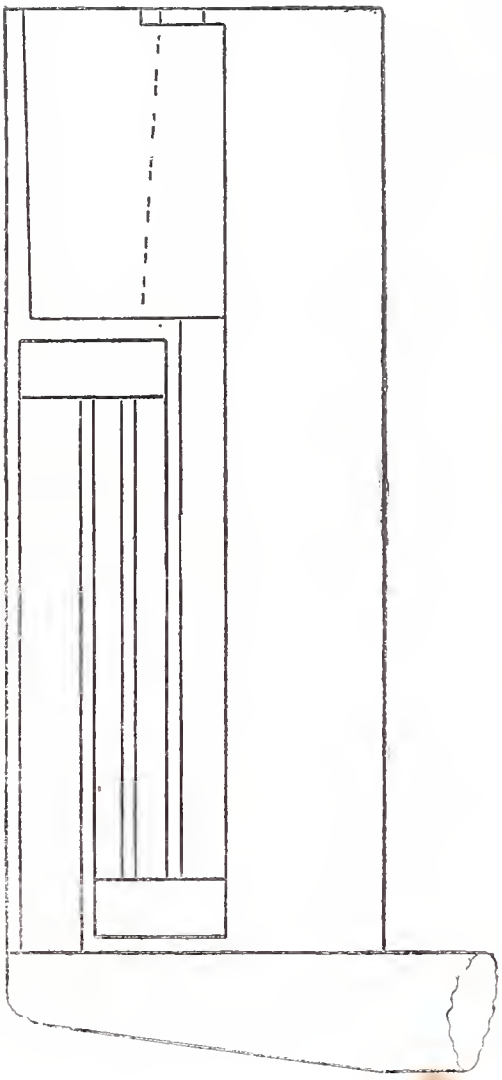
JOHN FITCH.

Ferry Boat on the Hudson River from New York to Hoboken. Engine and Boiler designed and constructed by Hogg & Delamater, New York.

	Feet.	Inches.
Length on Deck,	152	0
Breadth of Beam,	25	0
Depth of Hold,	11	0
Tonnage,	tons 396	
Draft of Water,	6	0
One Beam Engine.		
Diameter of Cylinder,	3	0
Length of Stroke,	9	0
Diameter of Paddle Wheels,	18	6
Length of Paddles,	9	0
Depth of "	2	4
Number of Paddles in each Wheel,	16	
Dip of Wheel,	2	4
Average Number of Revolutions,	22	
" Pressure of Steam,	lbs. 12	
Cutting off at	3	0
One Iron Boiler (below deck).		
Whole Amount of Fire Surface,	1115 square feet.	
" " Grate "	50 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$17\frac{1}{4}$ to 1.	
" " " Grate Surface,	$22\frac{3}{10}$ to 1.	
Area of 1st Flues,	6 square feet.	
" 2d "	6 "	
" 3d "	$4\frac{5}{10}$ "	
" Chimney,	$6\frac{3}{10}$ "	
Height of " above Grate,	55 feet.	
Consumption of Anthracite Coal per hour,*	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* The consumption of coal on this boat is 300 lbs. per hour during the entire day, a considerable portion of which time she is lying in dock. There is no means of telling her consumption while running. The boiler gives an ample supply of steam.



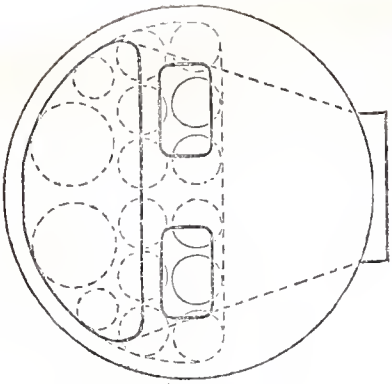


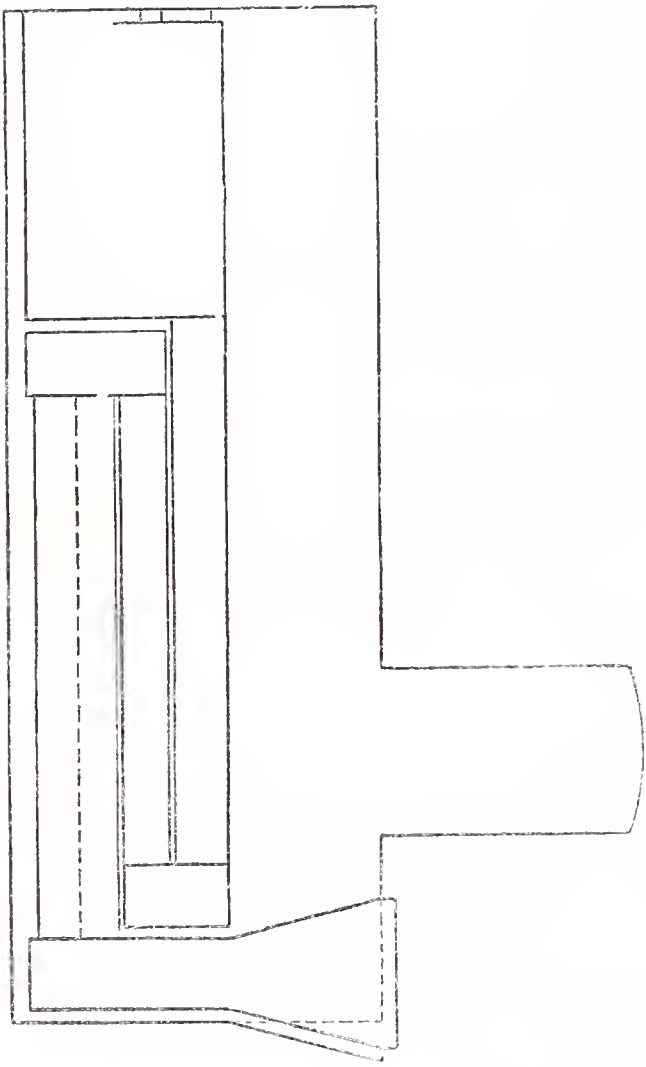
ONALASKA.

Ferry Boat on the East River from New York to Williamsburg. Engine and Boiler designed and constructed by George Birkbeck, Jr., New York.

		Feet.	Inches.
Length on Deck,		140	0
Breadth of Beam,		32	0
Depth of Hold,		9	0
Tonnage,	tons 330		
Draft of Water,		4	6
One Beam Engine.			
Diameter of Cylinder,		3	2
Length of Stroke,		9	0
Diameter of Paddle Wheels,		19	0
Length of Paddles,		7	0
Depth of " 14 ins. each, or		2	4
Number of double Paddles in each wheel,	28		
Dip of Wheel,		2	4
Average Number of Revolutions	25		
" Pressure of Steam, "	lbs. 20		
Cutting off at		4	6
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	1096 square feet.		
" " " Grate "	56 "		
Ratio of Fire Surface to cubic foot of Cylinder,	$15\frac{1}{2}$ to 1.		
" " " Grate Surface,	$19\frac{6}{10}$ to 1.		
Area of 1st Flues,	$7\frac{1}{10}$ square feet.		
" 2d "	$7\frac{1}{10}$ "		
" 3d "	$7\frac{4}{10}$ "		
" Chimney,	$9\frac{6}{10}$ "		
Height of " above Grate,	55 feet.		
Consumption of Anthracite Coal per hour,*	—		
Water Evaporated by 1 lb. of Coal,	—		
Coal per hour to a square foot of Grate,	—		

* No accurate means of ascertaining consumption of coal, as a considerable portion of time is spent in dock. The boiler gives an ample supply of steam.



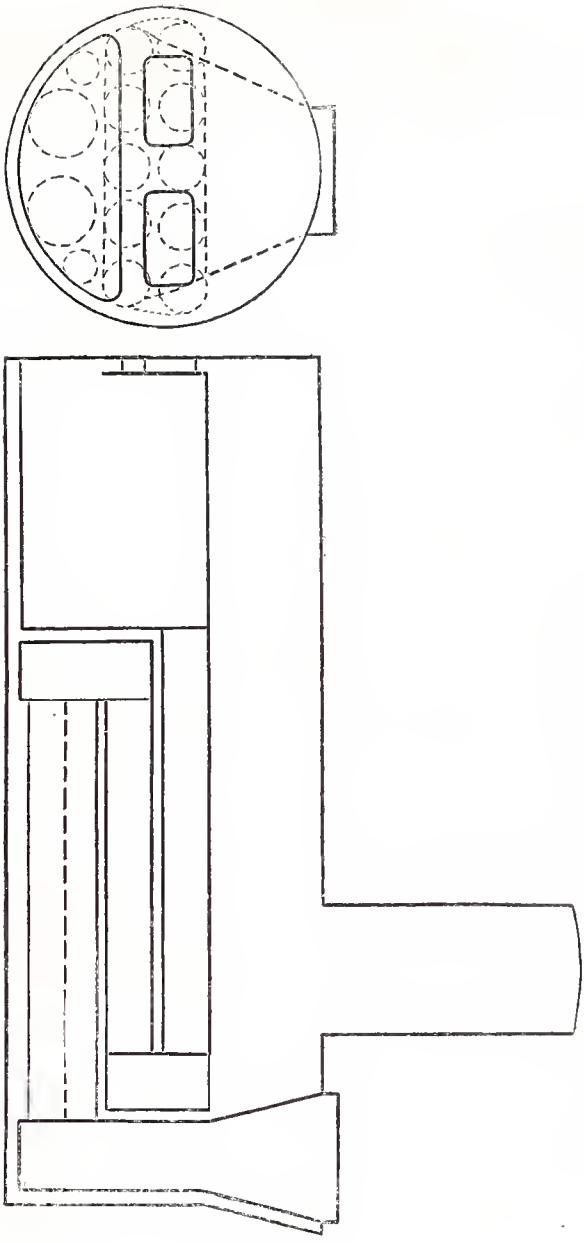


SENECA.

Ferry Boat on the East River from New York to Williamsburgh. Engine and Boiler designed and constructed by George Birkbeck, Jr., New York.

		Feet.	Inches.
Length on Deck,		120	0
Breadth of Beam,		30	0
Depth of Hold,		8	6
Tonnage,	tons 274		
Draft of Water,		4	3
One Beam Engine.			
Diameter of Cylinder,		2	8
Length of Stroke,		8	0
Diameter of Paddle Wheels,		18	0
Length of Paddles,		6	0
Depth of Paddles, 13 ins. each, or		2	2
Number of Double Paddles in each Wheel,	18		
Dip of Wheel,		2	2
Average Number of Revolutions,	25		
Average Pressure of Steam,	lbs. 20		
Cutting off at		4	0
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	712 square feet.		
" " Grate Surface,	36 "		
Ratio of Fire Surface to cubic foot of Cylinder,	16 to 1.		
" " " Grate Surface,	20 to 1.		
Area of 1st Flues,	5 square feet.		
" 2d "	5 "		
" 3d "	5 "		
" Chimney,	7 "		
Height of "	50 feet.		
Consumption of Anthracite Coal per hour,*	—		
Water Evaporated by 1 lb. of Coal,	—		
Coal per hour to a square foot of Grate,	—		

*No accurate means of obtaining quantity of fuel, for the reason stated in last boat. The boiler gives an ample supply of steam.

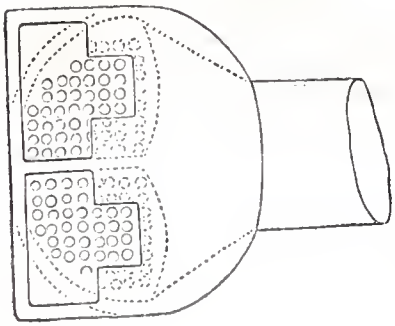


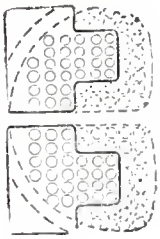
MERCHANT.

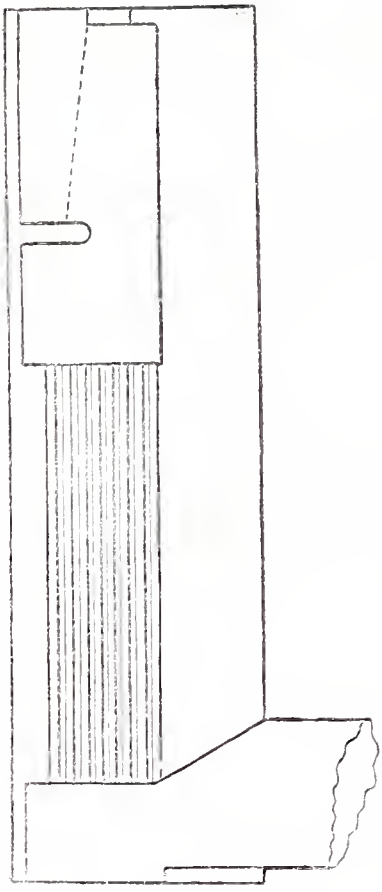
Ferry Boat on the Delaware River from Philadelphia to Camden. Engine and Boiler designed and constructed by I. P. Morris & Co., Philadelphia.

	Feet.	Inches.
Length on Deck,	115	0
Breadth of Beam,	30	0
Depth of Hold,	8	0
Tonnage, tons	245	
Draft of Water,	4	6
One Beam Engine.		
Diameter of Cylinder,	2	6
Length of Stroke,	9	0
Diameter of Paddle Wheels,	16	0
Length of Paddles,	6	0
Depth "	1	10
Number of Paddles in each Wheel,	14	
Dip of Wheel,	2	0
Average Number of Revolutions, (throttle $\frac{1}{2}$ open)	25	
Average Pressure of Steam, lbs.	30	
Cutting off at	4	6
One Iron Boiler (below deck).		
Whole Amount of Fire Surface,	1126 square feet.	
" " Grate "	$29\frac{1}{2}$ "	
Ratio of Fire Surface to cubic foot of Cylinder,	$25\frac{1}{2}$ to 1.	
" " " Grate Surface,	38 to 1.	
Area of Tubes,	6 square feet.	
" Chimney,	10 "	
Height of " above Grate,	50 feet.	
Consumption of Anthracite Coal per hour,*	—	
Water Evaporated by 1 lb. of Coal,	—	
Coal per hour to a square foot of Grate,	—	

* Consumes 4480 lbs. of coal in 14 hours, a portion of which time she is lying in dock. Boiler makes ample steam, and contains 94 3-in. tubes and 10 4-in. tubes.





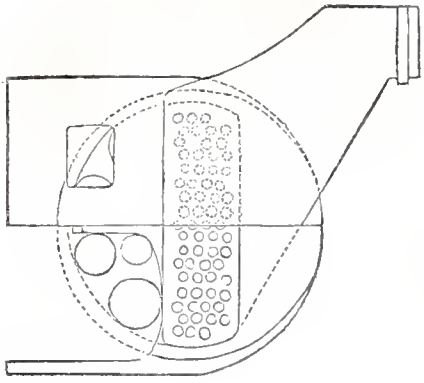


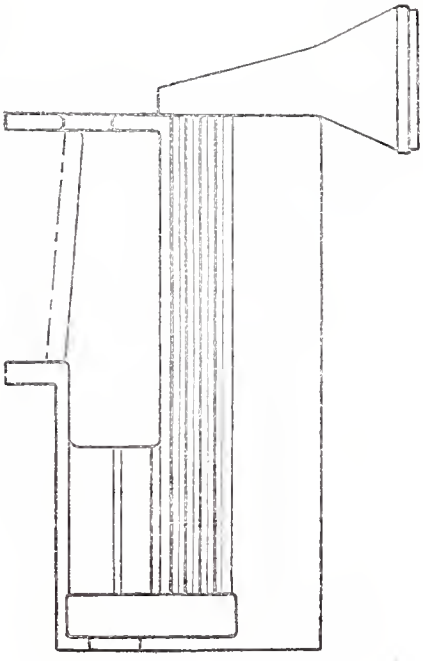
GORGONA.

Iron Steamer for the Chagres River. Hull, Engines, and Boilers designed and constructed by Mott & Ayres, New York.

	Feet.	Inches.
Length on Deck,	125	0
Breadth of Beam,	22	6
Depth of Hold,	7	0
Tonnage,	tons 184	
Draft of Water,	4	6
Two Engines (high pressure), slightly inclined.		
Diameter of Cylinders,	1	5
Length of Stroke,	5	0
Diameter of Paddle Wheels,	18	6
Length of Paddles,	7	0
Depth of "	1	4
Number of Paddles in each Wheel,	18	
Dip of Wheel,	3	6
Average Number of Revolutions,	18	
Average Pressure of Steam,	80 lbs.	
Cutting off at	3	2
Two Iron Boilers (on deck).		
Whole Amount of Fire Surface,	1664 square feet.	
" " Grate Surface,	66 "	
Ratio of Fire Surface to cubic foot of Cylinder,	106 to 1.	
" " " Grate Surface,	25 to 1.	
Area of 1st Flues,	$9\frac{3}{4}$ square feet.	
" Tubes,	$6\frac{1}{2}$ "	
" Chimney,	$8\frac{3}{10}$ "	
Height of ' above Grate,	38 feet.	
Consumption of Anthracite Coal per hour,	700 lbs.	
Water Evaporated by 1 lb. of Coal,	$6\frac{3}{10}$ "	
Coal per hour to a square foot of Grate,	$10\frac{6}{10}$ "	

* Results from trial trip.





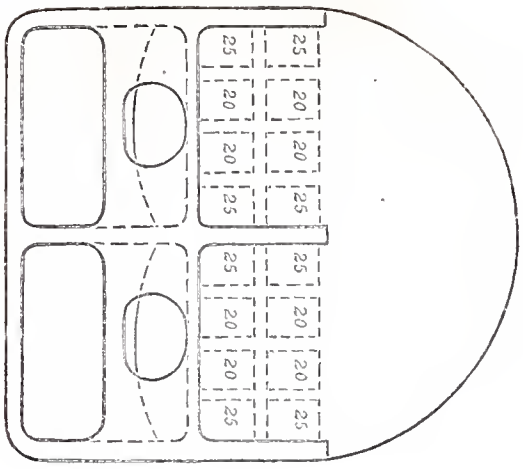
JOHN NELSON.

River Steamer running from New York to New Brunswick. Engine and Boilers designed and constructed by H. R. Dunham & Co., New York.

	Feet.	Inches.
Length on Deck,	265	0
Breadth of Beam,	28	0
Depth of Hold,	8	6
Tonnage,	tons 621	
Draft of Water,	3	0
One Beam Engine.*		
Diameter of Cylinder,	4	8
Length of Stroke,	12	0
Diameter of Paddle Wheels,	32	0
Length of Paddles,	10	0
Depth of "	2	4
Number of Paddles in each Wheel,	32	
Dip of Wheel, when light,	2	6
Average Number of Revolutions,	18	
Average Pressure of Steam,	lbs. 23	
Cutting off at	3	6
Two Iron Boilers (below deck).		
Whole Amount of Fire Surface,	4672 square feet.	
" " Tube "	3768 "	
" " Grate "	130 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$22\frac{8}{10}$ to 1.	
" " " Grate Surface	36 to 1.	
Area of Tubes,	16 square feet.	
" Chimney,	—	
Height of " above Grate,	—	
Consumption of Anthracite Coal per hour,†	2600 lbs.	
Water Evaporated by 1 lb. of Coal,	6 "	
Coal per hour to a square foot of Grate,	20 "	

* This boat has, in addition to large engine, two engines for forcing air through her bottom to reduce the friction of the water; they have cylinders 14 inches diameter, 4 feet stroke, and make 60 revolutions, cutting off at $\frac{1}{2}$ stroke; blast cylinders 40 inches diameter, 4 feet stroke.

† Fan blast under grate.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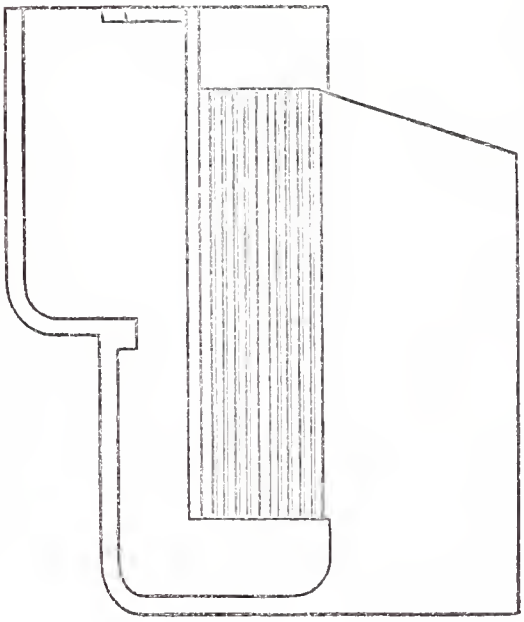
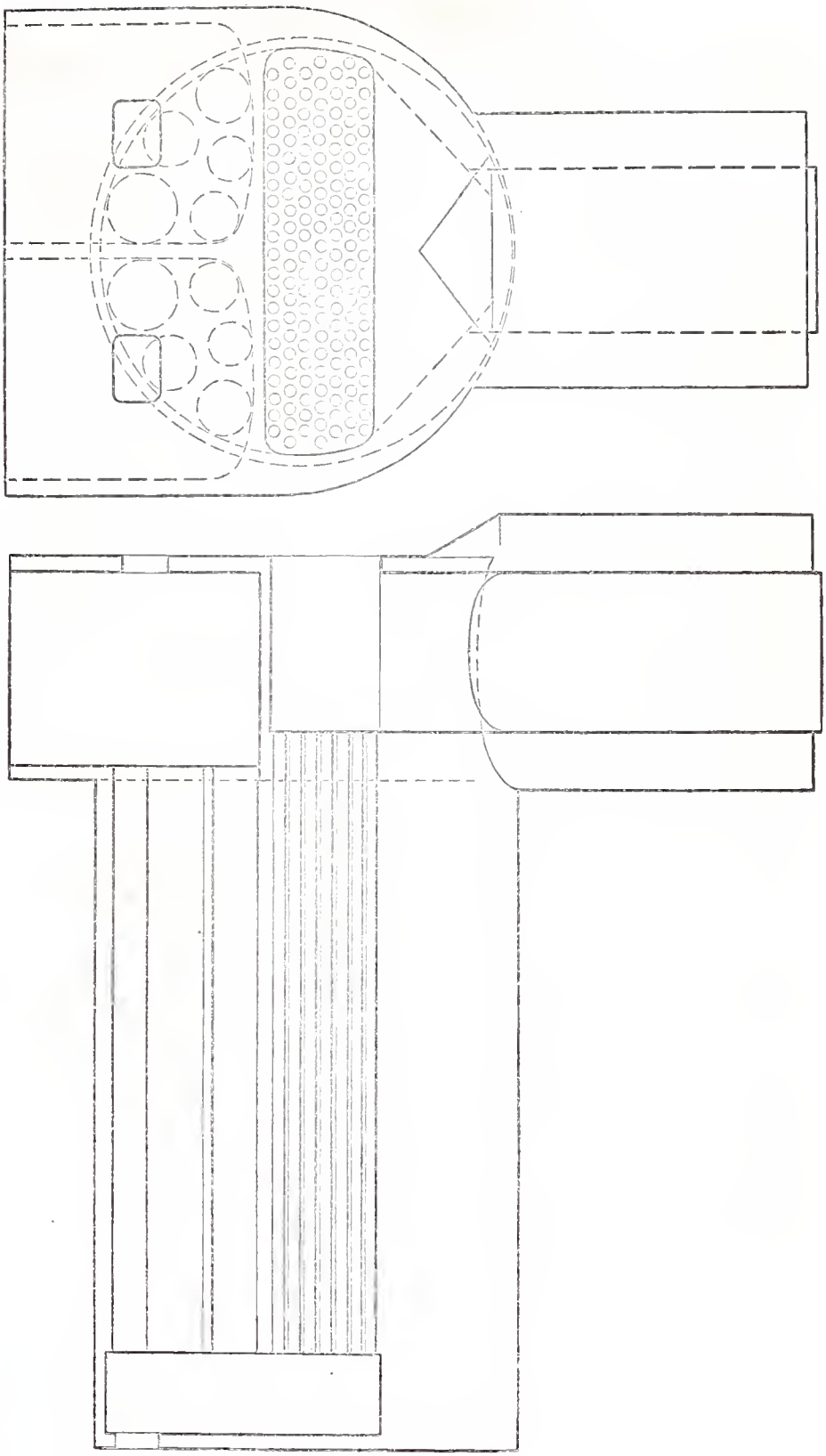


BALTIMORE.

River Steamer running on the Potomac. Engine and Boiler designed and constructed by Reaney, Neafie, & Co., Philadelphia.

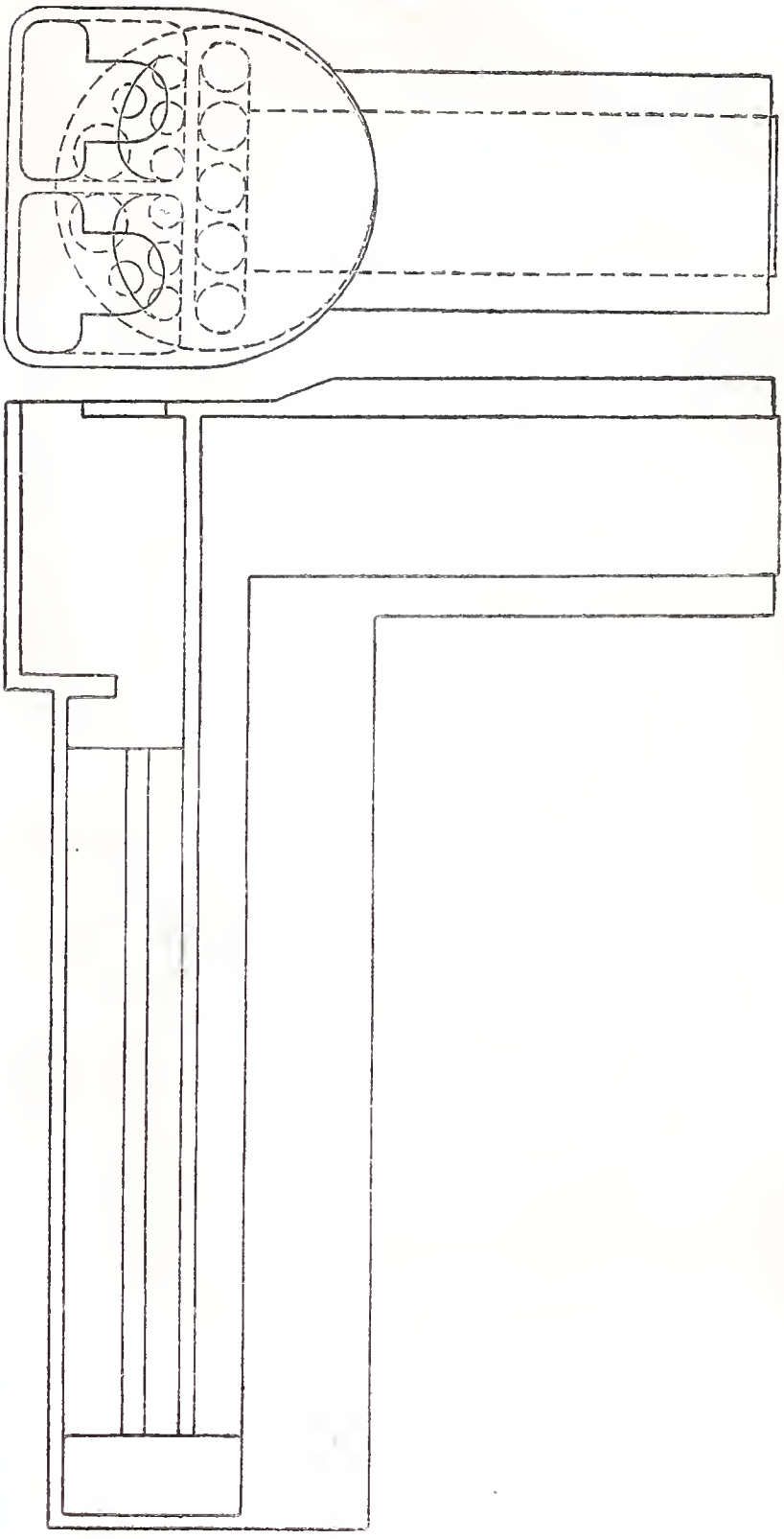
		Feet.	Inches.
Length on Deck,		200	0
Breadth of Beam,		27	0
Depth of Hold,		9	0
Tonnage,	tons 470		
Draft of Water,		3	6
One Beam Engine.			
Diameter of Cylinder,		3	$8\frac{1}{2}$
Length of Stroke,		11	0
Diameter of Paddle Wheels,		29	0
Length of Paddles,		9	0
Depth of "		2	0
Number of Paddles in each Wheel,	22		
Dip of Wheel,		2	0
Average Number of Revolutions,	21		
Average Pressure of Steam,	lbs. 30		
Cutting off at,			
One Iron Boiler (below deck).			
Whole Amount of Fire Surface,	2628 square feet.		
" " Grate "	60 "		
Ratio of Fire Surface to cubic ft of Small Cylinder,	$22\frac{1}{10}$ to 1.		
" " " Grate Surface,	$42\frac{2}{3}$ to 1.		
Area of 1st Flues,	$16\frac{1}{2}$ square feet.		
" Tubes	$11\frac{1}{2}$ "		
" Chimney,	$13\frac{1}{2}$ "		
Height of " above Grate,	—		
Consumption of Pine Wood per hour,	—		
Water Evaporated by 1 lb. of Wood,	—		



GENERAL TAYLOR.

River Steamer to run on the Hudson. Boilers and Wheels by John F. Rodman, Esq., New York.

		Feet.	Inches.
Length on Deck,		322	0
Breadth of Beam,		38	0
Depth of Hold,		10	4
Tonnage,	tons 1235		
Draft of Water,		—	—
A Rotary Engine of large size was intended to have been used, the piston making the same number of Revolutions as the paddle wheels, but although a portion has been constructed, it has been abandoned, and at present the size and form is not decided.			
Diameter of Paddle Wheels,		40	0
Length of Paddles,		11	0
Depth of "		3	0
Number of Paddles in each Wheel,	28		
Dip of Wheel,		—	—
Average Number of Revolutions,	—		
Average Pressure of Steam,	—		
Cutting off at		—	—
Four Iron Boilers.			
Whole Amount of Fire Surface,	5132 square feet.		
" " Grate "	208 "		
Ratio of Fire Surface to cubic foot of Cylinder,	—		
" " " Grate Surface,	$24\frac{6}{10}$ to 1.		
Area of 1st Flues,	33 square feet.		
" 2d "	$24\frac{1}{2}$ "		
" Chimnies,	$50\frac{1}{4}$ "		
Height of " above Grate,	—		
Consumption of Anthracite Coal per hour,	—		
Water Evaporated by 1 lb. of Coal,	—		
Coal per hour to a square foot of Grate,	—		

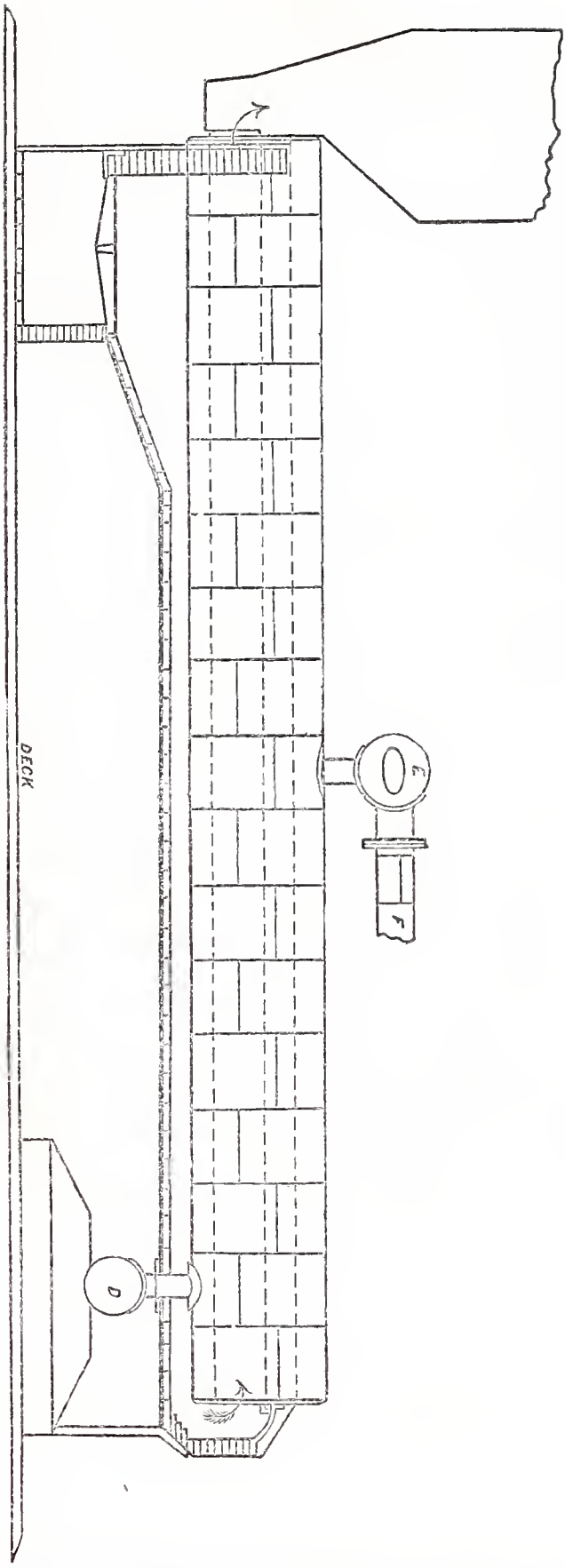


AMERICA.

(ON LAKE ERIE.)

Merchant Steamer running between Buffalo and Chicago. Engines and Boilers designed by S. T. Newhall, Esq., and constructed by Yeatman & Shield, Cincinnati.

	Feet.	Inches.
Length on Deck,	225	0
Breadth of Beam,	34	0
Depth of Hold,	12	0
Tonnage,	tons 876	
Draft of Water,	8	0
Two High Pressure Engines, slightly inclined.		
Diameter of Cylinders,	2	6
Length of Stroke,	11	0
Diameter of Paddle Wheels,	34	0
Length of Paddles,	10	6
Depth of "	3	4
Number of Paddles in each Wheel,	24	
Dip of Wheel,	3	0
Average Number of Revolutions,	17	
Average Pressure of Steam,	90 lbs.	
Cutting off at	4	2
Seven Iron Boilers, on deck.		
Whole Amount of Fire Surface,	3640 square feet.	
" " Grate Surface,	112 "	
Ratio of Fire Surface to cubic foot of Cylinder,	$33\frac{3}{4}$ to 1.	
" " " Grate Surface,	$32\frac{1}{4}$ to 1.	
Area of 1st Flue,	26 square feet.	
" 2d Flues,	25 "	
" Chimnies,	39 "	
Height of " above Grate,	60 feet.	
Consumption of Bituminous Coal per hour,	4480 lbs.	
Water Evaporated by 1 lb. of Coal,	$4\frac{1}{10}$ "	
Coal per hour to a square foot of Grate,	40 "	



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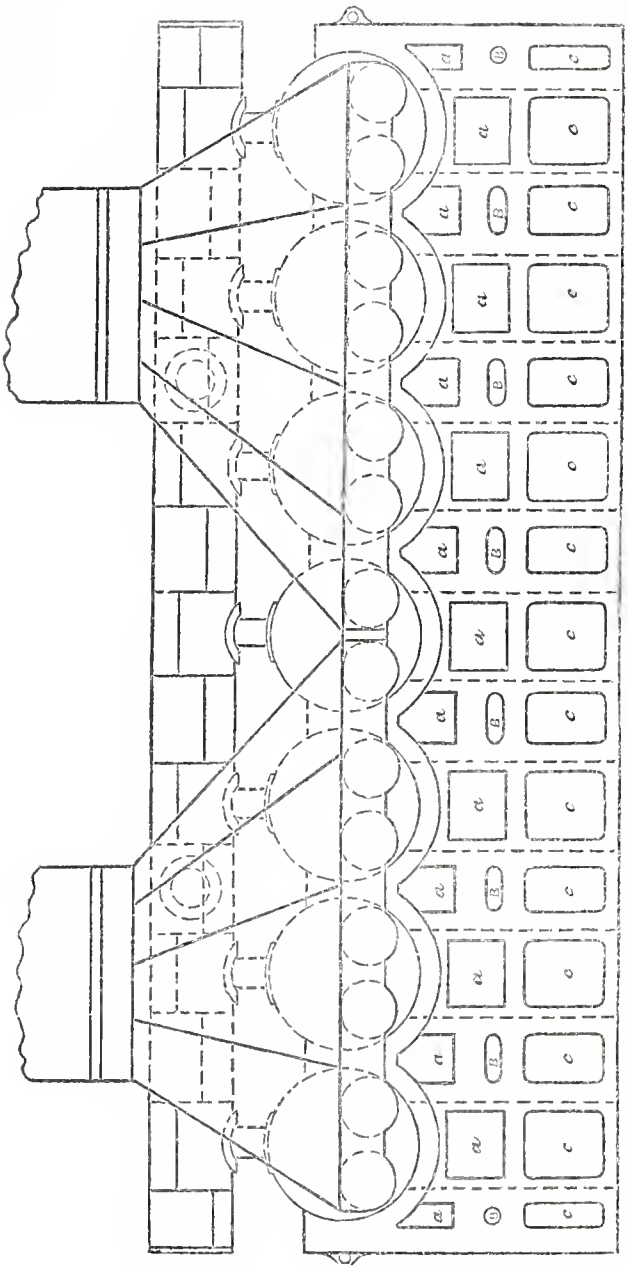

Front of Boilers.

WESTERN RIVER STEAMERS.

The form of boiler used in the Steamer America, on Lake Erie, and here shown, is the one universally adopted on our western rivers, and will probably continue to be used so long as they remain attached to their present system of high pressure engines. One drawing is a sufficient explanation. Their proportion of boiler may be seen from the following steamer built a few years since; no change of importance has taken place in that time that I am aware of.

STEAMER J. M. WHITE.

Length on Deck,	250	0
Breadth of Beam,	31	0
Draft of Water when light,	5	0
Two Engines, slightly inclined.		
Diameter of Cylinder,	2	6
Length of Stroke,	10	0
Diameter of Paddle Wheels,	30	0
Length of Paddles,	14	0
Depth of "	2	6
Number of Paddles in each Wheel,	18	
Seven Iron Boilers on deck.		
Diamater of Boilers,	3	6
Length of "	30	0
Whole Amount of Fire Surface,	2801 square feet.	
" " Grate "	108 "	
Ratio of Fire Surface to cubic foot of Cylinder,	30 to 1.	
" " " Grate Surface	26 to 1.	
Area of Flues,	17 square feet.	
" Chimnies,	32 "	

WHICH IS THE BEST BOILER?

Is a question that I have often been asked, and is one that is more easily asked than answered. Of the two ordinary forms of flue boilers I consider the drop flue preferable as occupying less space to produce a given effect. A good comparison may be made between these two forms by examining the boilers of the Bay and Empire State on Long Island Sound; the boats and engines being almost identical. Of tubular boilers there are two varieties, those having vertical, and those with horizontal tubes; so far as efficiency is concerned I do not think any difference would be observed where equal surface was presented to the action of the fire. Those with horizontal tubes take up less space in the length of the vessel, but more height than those having vertical tubes, unless the latter are made sufficiently high to withdraw a tube within the boiler, when its height would be as great as the former. The Miller boiler, recently brought forward by the Novelty Works in New York, has some advantages over the ordinary form of flue boilers, as it allows of increased grate and fire surfaee within a given space, and is somewhat lighter than the ordinary flue boiler for the same amount of fire surfaee.

I am of opinion that *equal* efficiency may be obtained with either of the forms of boiler (properly constructed) here shown; but there are many things, particularly in sea steamers, to be considered, and for them that boiler is the best which, *giving equal* effect, occupies the least space, always keeping in view the facilities for cleaning and repairs, two points that have been very much overlooked among us. There is one point to which I wish to draw particular attention, and that is the necessity of having an increased number of furnaces of redueed width in our boilers, and continuing the separation to the chimney if possible. The advantages to be derived from this arrangement are increased surface in immediate contact with the fire, and a very mueh more regular supply of steam, for it is evident that where a boiler has but two furnaces, nearly one-half of its efficiency is destroyed while our furnaces are being fired, and of course the pressure of steam is immediately reduced, and as one evil often begets another, so this has indueed the use of blowers on the principle that two wrongs make one right, I suppose, for that is the only one on which it can be advocated. *Sea steamers* should *never use blowers;* when they are really necessary their boilers *are defective.* These remarks apply with equal force, so far as number of furnaees are con-

cerned, to river steamers, but with them the increased weight of the boiler to obtain sufficient steam by natural draft would often exceed the extra quantity of coal consumed on the passage, (which occupies but a few hours,) and as speed is the primary object, the blower may be as much to be desired with them, as it is to be avoided in the former.

NOTE.

The quantity of water stated to have been evaporated by a given quantity of fuel, must not be taken as *strictly* correct; but where a comparison is to be made between two steamers of the same class, it will be found sufficiently accurate for all practical purposes, in obtaining information in relation to the consumption of steam and fuel. I found that nothing authentic could be ascertained in regard to the quantity of water *blown out* in marine steamers, and I have, therefore, not considered the losses from that source, or the steam lost in valve chests and at each end of the cylinder. On the other hand, it was just as impossible to obtain the pressure of steam on the piston, from want of indicators, and I was unwilling to adopt any imaginary rule for pressure, as that which would apply to sea steamers, running with throttle valves full open, would not apply to our river boats, where they are more or less throttled off, to maintain a full working pressure in the boiler. I have, therefore, taken the *pressure* as being the same both in the boiler and on the piston, and the *quantity* of steam used as being equal to the area of the piston multiplied by the length of stroke at which the steam was cut off, and the number of revolutions. As the management of our river, lake, and sea steamers differs as regards each other, but agrees in respect to each vessel of the same class, so the calculations of fuel here given will be found sufficiently accurate to compare one river steamer with another, or one sea steamer with another, but if a comparison is to be made between a river and a sea steamer, then an allowance must be made in favor of the latter, for the water blown out.

B. H. B.

Form 45

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Bartol

Marine Boilers

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